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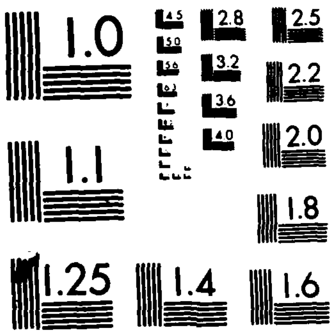

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Archeological Reconnaissance In The Big Sandy Drainage Basin: An Empirical Approach To Investigating Settlement In East Texas

May 1982

Final Report

Prepared for
Department of the Army
Fort Worth District, Corps of Engineers
P. O. Box 17300
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A total of 13 locations having cultural resource relevance were found during field work. In addition, 11 other sites were previously recorded by the Texas Archeological Research Laboratory or were reported to the survey team by local informants raising the total to 24. Statistical manipulations were prohibited by the small sample size, but the four prehistoric sites which were found during the field work were used to estimate a sample that would be amenable to statistical analyses under the economic models developed here. It is projected that a total of 60 sites would be sufficient to make strong decisions (with high levels of statistical confidence) about the location, kinds, and probable significance of Big Sandy cultural resources. In order to find this number of sites, it is projected that 19,200 acres, or 77.7km^2, would have to be covered.

ARCHEOLOGICAL RECONNAISSANCE IN THE

BIG SANDY DRAINAGE BASIN: AN EMPIRICAL

APPROACH TO INVESTIGATING SETTLEMENT

IN EAST TEXAS

Jon L. Gibson

Jon L. Gibson

Author and Principal Investigator

May 1982

Report Prepared for

the Department of the Army,

Corps of Engineers, Fort Worth District

under Contract DACW63-80-C-0041

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ACKNOWLEDGMENTS

The Big Sandy investigative program was carried out by an experienced project team, assembled by Archaeology, Incorporated. Mr. James Morehead and Mr. Timothy Phillips conducted the field work in an efficient and productive manner. They also aided materially in pre- and post-field work stages. They prepared soil maps which were used to determine sample plots. Mr. Morehead compiled data on field logistics, produced site maps, and narrated sections of Appendix I. Dr. Robert Gramling assisted in planning project design and analytical strategy. He also compiled notes on Euro-American culture history and helped to outline Chapters 3 and 6. He should, however, not be held accountible for any errors in fact or narration that may have resulted from the author's use of his input. Ms. Loretta Leger produced the typescript and helped with formating and proofing. Dr. Jon Gibson served as principal investigator and wrote the report.

Mr. Robert Burton of the U. S. Army Corps of Engineers, Fort Worth District, not only served as principal liaison with the contractor but provided valuable aids, advice, and reaction. LTC. Charles Lively served as contracting officer.

Ms. Carolyn Spock, of the Texas Archeological Research Laboratory in Austin, responded quickly with requested site locations and file information on previously known sites in the area. Mr. Jerome L. Johnson, U. S. Fish and Wildlife Service (Fort Worth) kindly furnished pre-publication, photocopies of habitats in the Big Sandy study area, and his kindness really facilitated correlation studies. Personnel at the U. S. Soil Conservation Service (Mineola office) and at the Texas Highway Department (Mineola office) were also helpful. Mr. Max Baker, County Agent for Wood County, divulged useful information.

Local residents were exceptionally helpful in disclosing site locations and in showing artifact collections. Mr. Robert Skiles, widely known amateur archeologist, instilled the field crew with an appreciation of local archeology that can only come with long familiarity with an area. Mr. R. W. Bailey, Mr. F. C. Martin, and Mr. William Poor gave information on site locations.

CHAPTER 1

ARCHEOLOGICAL RECONNAISSANCE IN THE BIG SANDY DRAINAGE BASIN: AN INTRODUCTION

BACKGROUND

The present investigation was conducted in response to plans by the Corps of Engineers, Fort Worth District, to undertake various water control projects in the Big Sandy area, Wood and Upshur Counties, East Texas (Figure 1.1). The principal project being planned is the construction of a reservoir which would inundate a large area of the Big Sandy Creek floodplain upstream from a proposed dam location near the junction of U.S. Highway 80 and Big Sandy Creek. To gain an idea of the kinds and numbers of cultural resources which might possibly be affected by the proposed reservoir as an aid to design and feasibility planning, the Corps contracted Archaeology, Incorporated, to perform a cultural resources reconnaissance of the general area.

This represents an aggressive effort by the Fort Worth District to discharge its obligations under various environmental, historical, and archeological statutes, e.g., National Historic Preservation Act of 1966 (PL89-665), National Environmental Policy Act of 1969 (PL91-190), Executive Order for Protection and Enhancement of the Cultural Environment (EO11593, 1971), Archeological and Historical Preservation Act of 1974 (PL93-291), and Archeological Resources Protection Act of 1979 (PL96-95).

CONTRACTUAL REQUIREMENTS

To insure that agency commitments to cultural resources conservation were met, the contractor was required to follow a detailed and innovative scope of services, prepared by Corps personnel and made part of Contract DACW63-80-C-0041. The scope of services permitted an essential flexibility in research designs and in investigative and interpretative dimensions, while insuring that agency needs and federal mandates were satiated. The major requirements of the scope of services are summarized below:

1. Before commencing field work, a detailed background study and research design shall be prepared and submitted for approval. This section shall be based on ingestion of information available from published and unpublished documents, site files, National Register

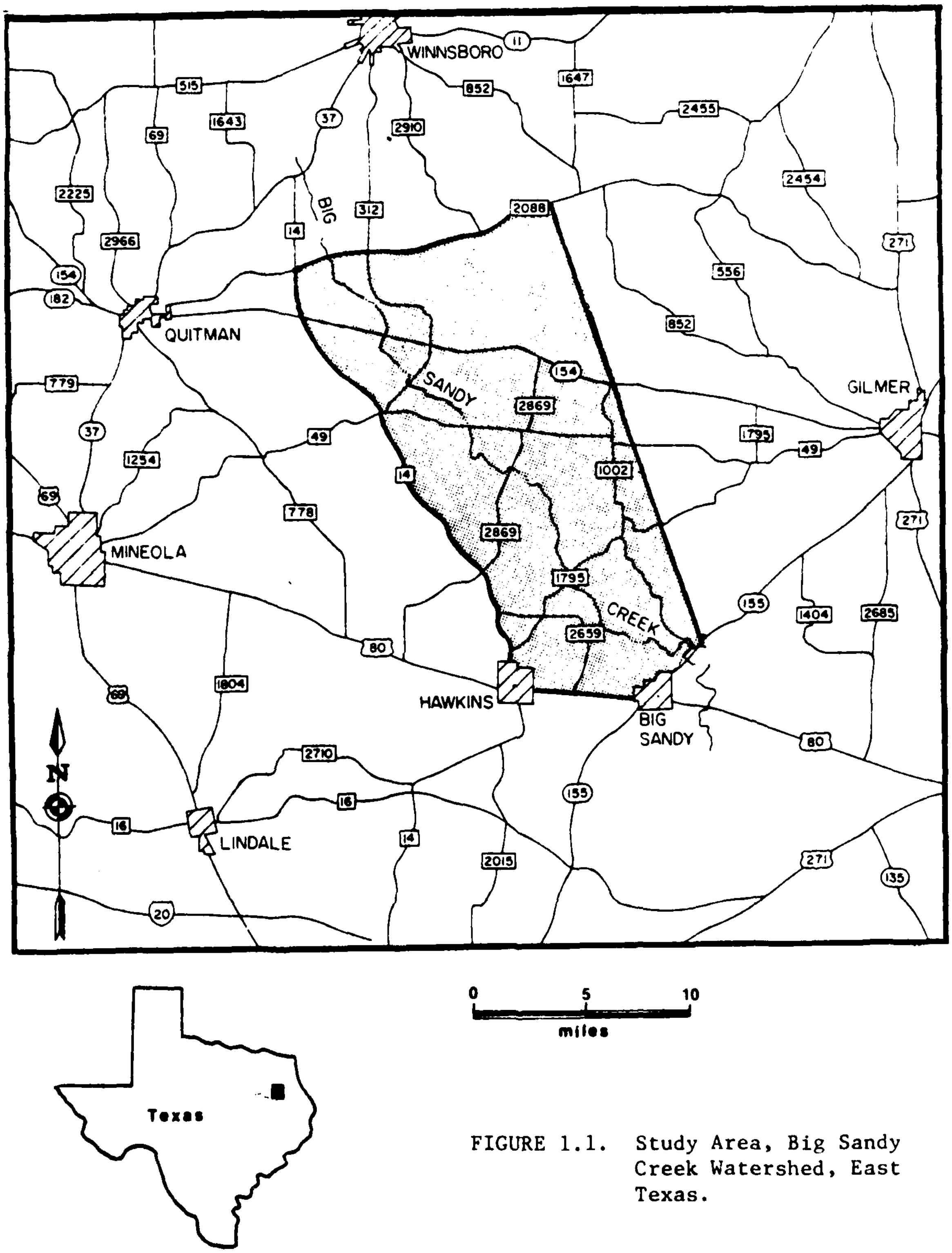

FIGURE 1.1. Study Area, Big Sandy Creek Watershed, East Texas.

lists, oral interviews, and other sources. This preparatory work shall be done to provide ideas on the nature of cultural resources expected in the project area and to detect problems and gaps in the existent data base and the kinds of information needed to respond to at least one subset of recognized problems. An annotated list of nonbibliographic sources of information shall be submitted as an appendix to this report.

2. Following the explicit research design produced under requirement 1, the contractor shall perform a field survey of 1280 acres ($5.18km^2$) of the project area. The scope of services required that the sample be drawn in a stratified random manner so as to include representative portions of different environmental zones. However, this requirement was relaxed when the research plan, developed by the contractor, incorporated hypotheses-testing dimensions predicated on a systematic approach to deriving sample areas (cf. C. W. Lively to J. L. Gibson, letter of 20 November 1980, approving research design and background study).

The scope additionally required that the field survey deploy efficient means of locating cultural resources remains, including ground cover removal and subsurface testing, the latter procedure limited to areas where alluvium, colluvium, or other recent masking phenomena might have obscured surface exposures. Details of conditions influencing the efficiency of the field survey were to be recorded.

On-site investigations were to be sufficiently exacting to determine site dimensions, environmental situation, evidences of disturbance, and landmarks which would aid in site relocation. In general, a noncollection policy was recommended, but if artifacts were retrieved to assist in satisfying certain research design elements, they were to be recorded to within 2.0m of their provenience. Subsurface testing was not demanded under this contract. The contract required that site locations be marked with a nonperishable device to assist in relocation.

3. Procedurally, the scope of services called for the submission of a background study and research design which would furnish the underpinnings of the field work and the framework for data collection, analyses, manipulations, and hypotheses-testing. This document had to be submitted and approved prior to initiation of field work. It is substantially as presented in Chapters 2-3. Maps and site forms (TARL) were to be submitted to the Corps office shortly after completion of field work, and draft and final reports were to follow later.

GENERAL DESCRIPTION OF PROJECT AREA

The project area specified by contract included a portion of the Big Sandy Creek floodplain and upland margins in Upshur and Wood counties, East Texas. Big Sandy Creek is a major tributary of the Upper Sabine River (Figure 1.1). It joins the Sabine River near the town of

Big Sandy, about 28km west of Longview and some 160km east of Dallas. Specifically, the project area was delimited on the south by U.S. Highway 80, on the west by Texas Farm Road 14, on the north by N. Lat. 32° 52.5', and on the east by a line bearing southeastward from the northern boundary at its intersection with Texas Farm Road 582 through Ambassador Airfield, about 4.8km east of Big Sandy, to U.S. Highway 80 (Figure 1.1). In area, this tract roughly covers about 660km^2. It should be recalled that the contract required a field survey of only 1280 acres (5.18km^2), or less than one percent (0.78 percent) of the total study area. The location of the sample tracts are shown in Figure 1.1.

The study area lies in the Austroriparian biotic province, an extensive ecological zone which stretches across the entire Gulf Coastal Plain to the Atlantic seaboard (Dice 1943; Blair 1950). The major forest community of this province is composed of pine and mixed deciduous hardwoods (i.e., pine edaphic forest; Odum 1971:387). This broad expanse of pineywoods exhibits considerable regional and topographic variability. Pine and pine-mixed hardwood dominate the higher elevations in the area, while mixed hardwoods fill the bottoms and dissections in the rolling, hilly terrain. Some 20-30km west of the study area, the pineywoods give way to the post oak savannah of the Texan biotic province (Blair 1950:100-102). Elevations range from over 185 to 83m msl (above mean sea level) with the higher elevations restricted to the hill summits on the northern and eastern peripheries of the study area and the lowest elevations confined to the Sabine River floodplain near the confluence with Big Sandy Creek at the southern margin.

The Sabine River furnishes the master stream of the locality. Its source lies in the Blackland Prairies, some 150km west of the study area. It traces a meandering course eastward and then southward for some 580km and enters the Gulf of Mexico near Orange, Texas (Ecosystems Management 1980:30). The upper section of the river, in the vicinity of the project area, is rather narrow, sluggish, and silt-laden with a pre-regulated average discharge of about 57m^3, or 2012 cubic feet per second (Ecosystems Management 1980:Table 5). The river floodplain is nearly 4.0km wide in the vicinity of the mouth of the Big Sandy Creek. The river is in a meandering condition with meander radii ranging from 0.2km to nearly 0.8km. Reaches, some covering distances of 1.5km, often intervene between meanders. Large relict floodplain features, created by Deweyville alluviation some 6000 to 30,000 (?) years ago, provide structural controls for the present stream course, particularly the long, straight reaches.

Big Sandy Creek, which joins the Sabine River about 5.0km southeast of the town of Big Sandy, is the principal tributary of the river in the study area. It is a braided stream, assuming meandering conditions only in the lower 10-15km of its floodplain. The Big Sandy floodplain exhibits a steep gradient, dropping from elevations of around 116m above msl at the northern boundary of the study area to about 85m above msl at its confluence with the Sabine River. Its floodplain varies from 0.6 to 1.2km across with greatest breadth

occurring near the Sabine River junction. The floodplain is abruptly demarcated by escarpments along the hill margins, where local relief may be on the order of 30m or more across the divide. Like the master stream, the floor of the Big Sandy floodplain is scarified by relict Deweyville features which control the course of the creek. The nearly 50km long stretch of creek which falls within the study area directly receives flow from more than 60 small creeks and branches, many of which are perennial and owe their permanent water supply to springs in the flanking hills. These small streams carve the paralleling uplands into a series of rather discrete hills and ridges which are generally interconnected only along the highest summits.

The topography of the study area is thus highly dissected, producing a "hills and hollers" terrain. The narrow creek bottom, as well as those of the larger, permanent tributaries, provides the only really "flat" zones in the area, if one excludes the highest summits of some of the adjoining hills and narrow crests along the ridges. Upland slopes are, however, quite variable in steepness, and there are many localities where relatively "flat" surfaces can be found, though these are often quite limited in extent.

The terrain has a determining effect on biotic communities. Habitats of the uplands may be separated into summit, slope, footslope, and upland aquatic niches. In some spots where uplands join creek bottoms, there are stretches of transitional, or ecotonal, habitats, which combine upland and lowland floral and fauna in flood-free situations. Creek floodplains incorporate several habitats (e.g., lotic aquatic, lentic aquatic, flats or glades, etc.), all characterized by periodic flooding, or inundation.

Environments of the study area will be examined in greater detail in Chapter 4.

THE BIG SANDY INVESTIGATIVE PROGRAM

Historical Outline of the Project

On 31 July 1980, Archaeology, Incorporated, was notified by the Forth Worth District of its selection to negotiate the Big Sandy archeological reconnaissance project. On 27 August 1980, the contractor submitted a proposal and budget, and on 3 September 1980, negotiations were conducted. Contract DACW63-C-80-0041 was finalized and submitted to Archaeology, Incorporated, on 29 September 1980. Preliminary work on the project began immediately with the drafting of the background study and research design and coordination with the Texas Archeological Research Laboratory in Austin, Texas. On 4 November 1980, the draft of these sections (cf. Chapters 2-3) was submitted to the Corps, which approved it by letter dated 20 November 1980, paving the way for the initiation of field work.

On 10 November 1980, project personnel were assembled and preparations for field work were initiated, and on 17 November 1980, field work on the Big Sandy reconnaissance survey began. Field work terminated on 17 December 1980. Report-writing ran concurrently with field-work and, along with analyses and other tasks, has occupied the time since cessation of field work and the submission of the draft report. This report, along with attendant maps and site forms, represents the culmination of all phases of research on the Big Sandy reconnaissance.

Investigation Themes

The Big Sandy cultural resources investigation constitutes a reconnaissance level survey (36CFRPart 66), or a first stage of investigation in a multi-level cultural resources management strategy mandated by federal laws and guidelines. The major practical objective of such studies is to produce an intelligent background on which construction design plans can be formulated so as to minimize adverse impact on significant cultural resources. As in all level-one programs, the Big Sandy reconnaissance was limited to physical, on-the-ground inspection of only a small part of the total area ultimately slated to be inundated, or otherwise affected, by the construction of a reservoir in the locality. As a matter of fact, the $5.18km^2$ area targeted for coverage under the contract represents only about 0.78 of one percent of the total study area, which embraces about $660km^2$. Under federal guidelines (cf. 36CFRPart 66), data (site locations and variability) produced by inspection of these small sample tracts are to be used to predict the occurrence of possibly significance resources throughout the entire area to be impacted. It is therefore requisite that sample areas be chosen in a fashion which allows expansion to unsurveyed portions of the project area and which permits, under some explicit and logical framework, decisions to be made concerning the value of cultural resources and the time, energy, and finances necessary to properly conserve and manage these nonrenewable elements of our cultural heritage.

Virtually all recent discussions of cultural resources have a common denominator--significance, or value, of these objectifications of human behavior cannot be separated in any meaningful way from the state of knowledge, as defined by what is known or unknown and by what we would like to know (cf. House and Schiffer 1975; Raab and Klinger 1977, 1979; Glassow 1977; Sharrow and Grayson 1979). In this sense, the federal requirement and the agency's need to determine significance is the same as the various cultural disciplines', joined in cultural resources research, perceptions of relevance to current and futuristic knowledge. In short, significance of any cultural resource is contingent on what that body of information offers to the enhancement of understanding.

In the most general sense, practically nothing about human tenure in the Big Sandy drainage basin was known prior to this investigation. No previous studies or comprehensive field investigations of its

prehistoric, protohistoric, or historic contents had been done. Site files, maintained by the Texas Archeological Research Laboratory, contained information on only 5 localities within the study area. Aside from this, and the information produced by the present reconnaissance, only six other sites were known (local collectors) within its confines. Information on these previously recorded locations was limited, confined mainly to locational and artifactual dimensions and to archeological abstractions based thereon. One authority (Woodall 1969b, 1980) had even cast the locality as a "vacant zone", a territory uninhabited during late prehistoric times. So in a very real sense, any gain in cultural knowledge resulting from the present survey could be regarded as significant, under any definition of the term.

However, even though no sites were known to the investigative team until shortly before field work commenced (and none during the time when the background study and research design were being constructed), cultural resources were expected in the locality, and the discovery and analytical procedures were designed to not only find such locations but to test certain models of land tenure, abstracted from the larger surrounding area of East Texas. Operating under this expectation and armed with a body of theoretical, methodological and substantive input, tempered by personal archeological familiarity and experience in East Texas and in environmentally similar regions, a unifying theme came to underpin the present investigation. The theme can be stated basically as follows: Humans adapt to environments they occupy within conditional limits established by population numbers, technology, and economic strategies deployed, in order to maximize return for the amount of labor expended. Humans must satisfy certain needs to survive, and these requirements are directly or indirectly dependent on the natural environment. Some localities can support more people than others given certain levels of technological efficacy and certain standards of living. The adaptive processes employed by population groups at any given time in the occupational history of a locality leave physical and/or reconstructible vestiges in the form of tangible residues which have spatial dimensions and which distribute geographically as a reflection of the nature and arrangement of the activities generated by these groups to insure survival at acceptable levels.

Thus, the present investigation is predicated on the supposition that if the level of technology and resources used by pre-modern populations can be determined, then the places (spatial and environmental dimensions) which occupant groups will chose to exploit and live can be revealed (i.e., predicted) by evaluating the qualitative and quantitative characteristics of natural regions. The working premise allowing conclusions to be derived under this approach is the principle of least effort, or to state differently, humans strive, consciously or unconsciously, to maximize returns for minimal investments of energy.

To illustrate this underpinning theme by example, we may say that pre-industrial folks whose economy was based primarily on hunting one or a few species of big game mammals would chose to live and exploit

those areas where biomass was highest and access easiest. For groups whose subsistence focused on nut and acorn harvesting, and small game hunting, natural areas which provided highest yields should bear the greatest number of remains of these and other supporting activities. Areas of high fish biomass should support higher densities of fishing activities and, consequently, higher numbers of archeological residues conditional on this adaptive strategy. Gardeners will need certain environmental conditions, e.g., arable and fertile soils, flood-freedom, growing seasons of adequate duration, and rainfall at certain periods, to insure cultivation of minimum labor expense within available technological means.

In sum, it has been supposed that careful quantitative and qualitative evaluation of natural resources and other environmental conditions could be used to define potential catchments, or zones of exploitation, as well as eliminate others. It has also been supposed that the potential catchment areas could be divided into two major kinds; those more amenable to exploitation under horticultural procurement strategies and those better suited to nonhorticultural adaptation. Defining such potential catchment areas on maps of the Big Sandy drainage basin not only served to define the sample area (i.e., the areas to be subjected to on-the-ground survey) but generated the expectations about the kinds of cultural resources anticipated to occur in both kinds of the catchment zones. The adopted empirical approach thus satisfied several major elements of the scope of services, e.g., problem-orientation, hypotheses-generation and -testing, and replication and predictability. It also permitted intellectual inquiry into a major problem area in East Texas archeology, that of cultural adaptation particularly as reflected in settlement forms and patterns. It is this area of inquiry that profers greatest opportunities for enhancing cultural knowledge in the region, given the nature of the information that can be assembled under a research program of this type. It is also from this stage that significance decisions can be most easily generated and that categories of relevance to the state of the art can be best demonstrated.

Project Constraints

The development and implementation of the Big Sandy research program has had to contend with several problems, problems which have compromized the idealism upon which the research design was predicated. There is nothing unusual in this admission. It is a typical state of affairs when intricately designed projects of this nature are faced with practical limitations of data bases and field work. However, in this author's opinion, it is better to admit to these constraints at the outset, rather than to try to cover them up with sophisticated analyses and erroneous conclusions.

Perhaps the most serious limitation of the research design itself lies in the construction of various catchment models. Ideally, models of potential catchment zones would have been more powerful if

qualitative and quantitative input had been more exacting and uniform. Information of abiotic and biotic elements within the Big Sandy drainage area was simply not available and extrapolations had to be made from adjoining and environmentally similar areas. Ground-truthing during actual field work did confirm that environmental projections, particularly with regard to species and species composition and soil distributions were justifiable but obviously this finding was of absolutely no aid in constructing potential catchments nor in placing them on survey maps, tasks which were performed before field work transpired. By the same token, arriving at quantitative dimensions of catchments was prohibited because details of carrying capacities, biomass, productivity, yields, caloric values, and other essential categories of information were also unavailable for many species known, or suspected, to have been exploited by East Texas populations. Because ecological details and population figures were either unavailable or nonuniform, the potential catchment zones have been defined on a rank-order basis (Chapter 4). While prediction of settlement forms and patterns is still possible, a good deal of the discriminatory power of the catchment models has been lost. In an attempt to bring the hypothesis-testing dimension into compatibility with the level of information precision underpinning the catchment models, it has been necessary to restrict to cultural pattern anticipations to broad economic patterns, i.e., horticultural and nonhorticultural bases. The rather gross nature of the potential catchment models are simply incapable of predicting adaptive patterns and settlement correlates of any particular cultural group or time period, such as for example, Sanders or Titus focus occupations. Such analytical constraints have not prevented speculations on possible catchment models and procurement strategies for these specific cultural entities (cf. Chapter 2). They have, however, obviated any prospects of testing these models, or hypotheses generated from them, with the presently limited corpus of information.

The field phase of the Big Sandy project also ran into complications; none that appear to have seriously compromized its results but complications which nevertheless did impair its efficiency. All of the possible catchment areas (horticultural and nonhorticultural) were drawn on project maps prior to field work. Equidistant from the circumferences of these potential catchment zones were drawn interconnected lines which represented off-catchment (noncatchment) survey paths. Half of the survey transects were designed to be run within the encircled catchments, half outside them. Although these survey paths were not sacred, their pre-field work distribution did seem to be the most systematic pattern for affecting extensive coverage of the entire study area while adhering to the curt completion schedule.

Access problems prevented coverage of several of these transects and an entire nonhorticultural catchment area selected for survey. Large sections of the study area, particularly on the northern and eastern sides, were under lease to hunting clubs, and hunting season was in full swing for the duration of field work. Thus retargeting of some sample plots had to be done during the survey phase, and

the necessary substitutions, while still falling within the parameters of the research design, were not as desirable test situations as the areas which had to be avoided.

Three weeks into the field survey it became apparent that on-the-ground coverage was proceeding at a pace which would not permit the completion schedule to be met. A combination of conditions, e.g., logistics, adverse weather, and slow-down due to access negotiations with landowners, was partly responsible, but the major factors contributing to the slow progress were ground cover and the absence of vehicular ingress points to several of the perscribed transects. Many of the pre-selected survey transects fell in wooded areas, a desirable situation because modern disturbances should have been minimal. However, logging activities during the earlier part of this century turned many of these areas into virtually impenetrable thickets. Pedestrian passage through these thickets was slow and tedious and required a good deal more effort to insure that inspection intensity was maintained. In addition, leaf-fall was well along and was practically completed by the end of the survey. Nearly constant removal of fallen leaves was required to permit inspection of bare ground surfaces and this activity further slowed progress.

Ingress to several of the off-catchment transects was possible only by walking to the survey alinement from the nearest vehicular access point, sometimes several hundreds or even thousands of meters distant. By the same token, completion of the pre-selected transect walk-through often left the survey team considerable distances from the field vehicle. To remedy this situation, which obviously was compromizing the completion schedule, several transects, primarily off-catchment ones, were rerouted to alinements that paralleled existing roads. Here, it was possible to conduct the walk-throughs in a "leap-frog" manner. A crew member would walk a prescribed segment of the transect, pick up the truck and drive to a predetermined point ahead of the second surveyor. The vehicle would be left for the second surveyor while the first would cover the corridor intervening between the parked vehicle and the next transfer point. This procedure was repeated until the transect was covered. While this required modification of survey procedure by itself did not sacrifice coverage intensity, it did hamper the extensiveness of coverage which would have resulted if the pre-field work transect design could have been followed to the letter. What effects, if any, these alinement changes might have had on survey results are not ascertainable at present. It has not, however, caused any difficulty with the implementation of the research design or strategy because the choice of the sample areas to be surveyed were not based on randomizing procedures but on selectivity predicated on model-generated criteria.

SUMMARY AND CONCLUSIONS

The Big Sandy reconnaissance survey represents an initial effort to find and evaluate cultural resources in a 660km^2 parcel of bottomland and hills along a major tributary of the Upper Sabine River in East Texas. It is a sampling investigation, restricted by contract specifications to physically cover only a 5.18km^2 section of the total study area. The framework of investigation has been designed to accommodate an inquiry into nature and arrangement of cultural resources over the landscape in an effort to test certain hypotheses dealing with modeled relationships among populations, procurement and settlement strategies, and natural environmental potentialities. The approach followed in this investigation is not only relevant to problem-solving and possible enhancement of cultural knowledge in this little known drainage basin but has produced a corpus of practical, predictive information that can be used by the Corps of Engineers in designing a program of cultural resources management for the prospective reservoir.

CHAPTER 2

A GENERAL PERSPECTIVE ON CULTURAL ADAPTATIONS IN UPPER SABINE VALLEY PREHISTORY AND HISTORY

INTRODUCTION

The culture history of the Upper Sabine River Valley extends over at least 12 millennia. Of this span, only the last two and a half centuries are known from documentary records. The remainder is prehistoric and has been reconstructed by archeological means. The prehistoric span deals exclusively with the Indian. The eighteenth century forward concerns people of various racial, ethnic, and national origins, e.g., Indians (Native Americans), Spanish and French colonists, and finally nationalized Americans.

THE GROUNDWORK OF PREHISTORIC RECONSTRUCTION

Humans are nature's finest pragmatists. Like other living organisms, they have certain well defined needs--food, water, shelter, etc.--but in addition to purely instinctive behavior, humans have the capacity of free thought. How humans chose to satisfy their needs and desires is the primary area of concern to anthropologists, for the result of need satiation is culture--that patterned, repetitive system of cooperative behavior that enables adaptation.

Although human needs remain relatively constant from person to person and group to group, there are subtle to extreme disparaties in the means chosen to insure adaptation that are reflected from locality to locality on a contemporary time level and that show up with the passage of time. The sources of these differences are myriad. They may be reflected in degrees within a single culture subsystem (level) or in distinctive subsystems. They may be reflected in the nature (form and content) of the subsystem, in the organization of the components of subsystems, or in the overall structure of the internetworked subsystems that comprise distinctive cultural entities.

The simple fact that there are differences (as well as similarities) in the residual products of prehistoric cultures has enabled archeological reconstructions even though written descriptions are

nonexistent. The portrayal of prehistory, however, is not uniform. It, like the sequences it intends to reveal, is highly variable, dependent on where and how individual investigators place their emphases and on which corpus of archeological data they chose to stress. This lack of uniformity is a function of the absence of general theory in archeology.

The lack of theory and rise and fall of various operational paradigms has, in this author's opinion, effectively divorced archeological reconstructions from any necessary correspondence, or even resemblance, to once-existent socio-political entities. Some archeologists (cf. Willey and Phillips 1958; Griffin 1973) have expressed the belief that effectual archeological typologies will coincide with parcels, or discontinuities, of past socio-political realities. Such beliefs, however admirable, remain unsupported by current archeological practice and may, in fact, be unsupportible.

Illustrating this view with an East Texas example, we need only draw attention to the historic Hasinai peoples of the Upper Neches region. Some nine to eleven small tribes were loosely linked in a defensive alliance known as a confederacy. The socio-political nature of the Hasinai is well established through written documentation. By way of contrast, consider the classifactory unit called Pre-Caddoan. In archeological parlance, Pre-Caddoan refers to all manner of pottery-yielding situations in the so-called Caddoan area which lack distinctive Caddoan styles. Not only does the term fail to convey inherent socio-political, or any other cultural boundary, information, but it includes so much material cultural variability that any effort to model social or cultural correspondences to the breadth of the situations encompassed by the term Pre-Caddoan seems misguided and informationally unproductive.

Since there seems to be such a wide range of cultural possibilities implicit in archeological typological units, e.g., pottery style sharing zones, interaction spheres, technocomplexes, as well as social, political, ideological, and attitudinal networks, etc., it hardly seems worthwhile to be concerned with whether or not typological units can be designed to fit limits of past cultural discontinuities whatever their nature. Existent typologies serve as heuristic frameworks for conceptualizing material culture similarities and dissimilarities and for enabling communication among archeologists. They need be nothing else.

The prehistory of East Texas is presently conceived within a typological framework, a framework with its roots in the Midwestern Taxonomic System developed by W. C. McKern (1939). McKern's system was essentially "genetic"; that is to say, it outlined an ascending heirarchy of typological units based on degrees of artifactual similarities. At the bottom of the McKern scale was the <u>component</u> (i.e., single "pure" sites or stratigraphic levels at long-occupied sites). Highly similar components were grouped into <u>foci</u>, which are actually the basic operational units of the classifactory system. Similar foci were grouped into <u>aspects</u>; similar aspects, into <u>patterns</u>; and finally, similar patterns, into <u>bases</u>. Despite the lack of rigorous ordering methodology (level groupings are almost entirely subjective units), the

McKern scheme was quite logical, internally consistent, and capable of practically unlimited expansion. Yet since it was predicated on a "genetic" principle, it did not inherently respond to the major objective being almost singlemindedly sought by archeologists of the day--the objective of chronological ordering.

McKern's system was quickly adapted to East Texas prehistory by Alex Krieger and associates (Krieger 1946; Newell and Krieger 1949; Suhm, Krieger, and Jelks 1954; Suhm and Jelks 1962). While much of the "genetic" principle survived this adaptation, Krieger and colleagues imbrued the scheme with an additional ingredient--time. Working largely independent of Krieger, Clarence Webb was, at the same time, adapting the McKern system in a similar fashion to the archeological complexes on the eastern margins of the so-called Caddoan area (Webb and Dodd 1939; Webb 1948, 1959; Fulton and Webb 1953). What emerged from this application of McKern was initially a two part breakdown of late prehistory (i.e., Caddoan "culture") into Gibson (the earlier) and Fulton (the later) aspects. Each aspect was divided into one or more foci, which in addition to their formal content were accorded successive temporal parameters. The Gibson aspect was comprised of Alto, Gahagan, Haley, Spiro, and Sanders foci, generally corresponding to distinctive geographic territories within the four-state Caddoan area. The later Fulton aspect incorporated several geographically distinctive foci: McCurtain, Mountain Folk, Whelan, Texarkana, Titus, Belcher, Bossier, Mid-Ouachita, Angelina, and Frankston. Historic Caddoan foci included Glendora and Allen, and added later were Lawton and Little River (cf. Williams 1964).

Cultural chronological segmentation of the archeological record prior to the emergence of the distinctive Caddoan pottery styles has added additional aspects and foci--Fourche Maline, Lowland Fourche Maline, and Bellevue (often clumped as "Pre-Caddoan" manifestations) and LaHarpe (a late Archaic unit, Johnson 1962).

This list of cultural historical units is not intended to be exhaustive, only illustrative of the nature and magnitude of the manner of historical classification in the Caddoan area. Cultural manifestations earlier than Late Archaic (LaHarpe Aspect) have not been subjected to the same kind of intensive classificatory ordering; a direct result of the paucity of available archeological information. However, they are recognized by rubrics, such as Middle Archaic, Early Archaic, and Paleo-Indian.

More recently, Caddoan area prehistory has been arranged into a culture period format (Caddo I-V) by stressing certain temporal discontinuities in artifactual forms and styles and broader geographical similarities than were formerly recognized under the "genetic" McKern system. Augmented by a radiocarbon framework, the new arrangement, in Davis' (1970:40) words, ". . . comes closer to reflecting historical reality than the two-part Gibson-Fulton framework". This author agrees with Davis' assessment if the word historical (not cultural or

socio-political) is emphasized. However, regardless of its new wrapping, Caddoan area archeology continues, and will likely continue for a long time to come, to be communicated in terms of the familiar McKernian unit--the focus.

It would be a simple task to set forth East Texas culture history within the culture period-focus framework currently in use. However, it is quite doubtful that the summary nature of such a presentation would do justice to the flow of prehistory or capture its fullness. It is also doubtful that this author's capsule view could improve on similar summary expositions of East Texas prehistory found in Davis (1970:27-65) and in Skiles *et al*. (1980). Instead this discussion will adopt a different presentation format, one more in line with the approach underpinning the present investigation and compatible with its several objectives; that approach being predictions of site locations and variability. This is not to say that neither the familiar culture historical units nor the historical sequences they form will not be used. They will be used, for to do otherwise would relieve this presentation of any communicative value. No, what is intended by this novel format is to shift emphases away from purely historical considerations to culturally substantive concerns of pre-modern economies, subsistence strategies, and settlement organizations. Time remains an essential ingredient, history *per se* does not.

UPPER SABINE VALLEY PREHISTORY WITHIN THE CONTEXT OF CADDOAN AREA ARCHEOLOGY

Prehistoric (and even modern) systems of adaptation can be conceptualized as segments along a continuum from highly specialized to highly generalized (Cleland 1966, 1976). To describe this continuum, Cleland (1966, 1976) proposed the term, "focal-diffuse model". According to Cleland, focal adaptations were those which centered on exploitation or production of a single or a few similar resources; diffuse adaptations, on the other hand, were those which made use of a wide variety of distinctive resources. Resources in this context are nearly synonomous with foods. While Cleland (1976:61) carefully points out that such opposite extremes are hardly ever met with in reality, adaptive systems, because of certain energy expenditure factors and limitations, will always tend toward one pole or the other, they cannot fall in the middle. Since the theme of human adaptation underpins the present work, Cleland's "focal diffuse model" becomes a logical means for organizing Upper Sabine Valley culture history.

Diffuse Adaptations in East Texas

Under the Cleland scheme, several East Texas adaptive strategies may be classified as diffuse, or as being geared to the exploitation of a large variety of resources. Cleland (1976:46) characterizes diffuse adaptations thusly:

> Diffuse adaptations, . . . appear where resources are varied, scattered, and where no one resource, or few resources, are abundant or reliable to promote economic security. The economy of people with diffuse adaptations is based on the careful scheduling of exploitation, so that natural availability of resources is maximized and so that alternative resources are available. The key to such an adaptation is movement between resources in time and space. As a result, diffuse adaptations may appear only in areas of high ecological diversity.

Early Diffuse Adaptation: Paleoindian

Traditionally, Paleoindian adaptation has been considered as centering on the specialized hunting of Pleistocene megafauna. Under such a view, one might ask why Paleoindian adaptations have not been classified as focal. There are several reasons for this counterproposal. Increasing evidence discloses that a much wider variety of game animals contributed to Paleoindian food stuffs (Johnson 1977). For example, Clovis people, who have been cast as specialized mammoth hunters also consistently took a variety of other large mammals such as bison, horse, and camel and occasionally sloth, bear, and tapir (Johnson 1977:66-71). Their tablefare additionally included duck, turkey, rabbit, muskrat, and turtle (Johnson 1977:72-75). This is a fairly wide variety of animals, considering the presumed concentration on mammoth and suggests, not only a factor of opportunism, but a much more diverse hunting strategy. While large herding animals, particularly the mammoth, may have, because of large size and accessibility, furnished a major scheduling criterion for hunting strategies, it is apparent that hunting activities themselves intersected the ranges of many other species and afforded opportunities for exploitation. Actually, these nonherding species and small (even seasonal) game were probably not merely "cheap" foods, or lagniappe. They probably got Clovis peoples around the natural constraints always inherent in a single exploitated ecosystem. In other words, they helped to maintain balance, or equilibrium, in Paleoindian economy by alleviating "lean times", when mammoths were unavailable or when dried meat stores were exhausted.

The same characterization might be extended to Folsom adaptations, which succeeded Clovis throughout the plains and desert southwest (though apparently not in the eastern United States). However, by Folsom times (10,000-9000 B.P.), most of the megafauna had become extinct, and bison evidently became increasingly important in subsistence as evidenced by mass kills (Johnson 1977). Thus Folsom adaptation may have become increasingly specialized (i.e., focal) as bison herds swelled and filled in the niches vacated by other herding animals that became extinct. However, caution must be expressed in according too much emphasis on the apparent increasing focal nature of adaptation during Folsom times (as well as Clovis) as the role of plants and their contribution to Paleoindian subsistence has not been

specified. If plant information was available, it is conceivable that the entire complexion of Paleoindian economies might be quite different. It would certainly have to be reassessed.

What does this new perception of Paleoindian adaptation mean for East Texas, particularly the Upper Sabine Valley? Empirical data on Paleoindian from the piney woods of East Texas are exceedingly few. Scattered surface finds of projectile points, mainly Scottsbluff, Plainview, Meserve, Angostura, and Clovis, furnish the major body of evidence for Paleoindian occupation or utilization (Davis 1970:35-36; Skiles et al. 1980; Shafer 1977:190-195; Johnson 1962:180-183). The representativeness of the data base is questioned by both Davis (1970) and Shafer (1977) because of collector bias toward projectile points, a common lack of provenience information, and often poor contextual data (i.e., surface finds or occurrence in shallow deposits mixed with materials from other assemblages). While there is legitimacy to the concern over data representativeness, there are certain aspects of the East Texas Paleoindian record that bear recognition because of widespread (presumably bias-free) commonalities.

Collector bias toward projectile points should not be responsible for the failure of Folsom points to occur in collections. These points simply do not show up in East Texas collections (cf. Skiles et al. 1980) or in those from West Louisiana (Gagliano and Gregory 1965), and, in fact, without expanding the typological parameters for Folsom points, they are generally missing from the eastern United States. This author, following Shafer's (1977) general lead, suggests that the apparent absence of Folsom points in the East Texas-West Louisiana area may be due to the absence of specialized (focal) adaptive strategies of the Folsom pattern, especially as known for the High Plains, Staked Plains, and Desert Southwest.

Another matter of record assumes large importance. Although relevant data are sparce for the Texas side of the Sabine River, Gagliano and Gregory's (1965) study of lanceolate, Paleoindian projectiel points from western Louisiana revealed that the overwhelming majority were made of materials exotic to both western Louisiana and eastern Texas. In Gagliano and Gregory's sample, 77 percent of the Clovis points were made of Central Texas flint, Arkansas novaculite, and white Missouri chert; 80 percent of the Scottsbluff varieties were of Central Texas flint; and 50 percent of the unfluted Clovis forms (probably Plainviews) were of Central Texas flint (Gagliano and Gregory 1965:66, 68, 73). The occurrence of these exotic flints is strong evidence for presuming that regional Paleoindian catchment zones embraced abiotic (entropic) resources far outside the Sabine River drainage system. A circle with a radius of 600km centered on the Upper Sabine Valley would embrace all of the known sources of lithics used by East Texas-West Louisiana Paleoindians; 600km to the southwest, the Central Texas flints; 600km to the northeast, the white Missouri cherts; and, in route to the latter at distances of 300-400km, the Arkansas novaculites. This proposed breadth of Paleoindian catchment is virtually identical with the findings of Hester and Grady (1977:90-92) in their

analysis of plains and desert Paleoindian catchments and may have relevance to some as yet undetected and widespread commonality of Paleoindian adaptative strategies (and economic catchments).

Yet there is another, possibly more revealing, pattern in the distribution of Paleoindian materials. In their catchment analyses of western Paleoindian sites, Hester and Grady (1977:90-92) found that percentages of raw materials used at any given site varied inversely with distance from source area; in other words, lithic source areas closer to the sites themselves furnished larger percentages of technological raw materials than those materials located at increasingly distant points. All industrial materials were available within 600km of individual sites (Hester and Grady 1977), seemingly fixing a maximum range to exploitation, or catchments. This finding is certainly compatible with the principle of least effort and with nearly any other economic rule one can conceive (cf. Earle 1980; Christenson 1980). This principle, revealed empirically in the Paleoindian example just cited, is the operational premise of site catchment analysis (cf. Vita-Finzi and Higgs 1970).

In terms of the Upper Sabine Valley, we are presented with a situation in which the large majority (50-80 percent) of Paleoindian projectile points is made of raw materials which derive from distances of between 300 and 600km away. Since three primary source areas furnished the technological materials and since the two most distant sources lie on opposite sides of the Upper Sabine Valley (the third source lies in route to the Missouri quarries), it is evident that the Upper Sabine region falls at or near the halfway point between the two most distant sources of industrial lithics. To state this in economic catchment terms, the Upper Sabine Valley may be logically presumed to lie in the outer radial bands of two, and possibly three, Paleoindian territories; one embracing part of the present state of Arkansas and portions of Missouri, and possible Oklahoma; the other centered in Central Texas north of Austin (cf. Hester 1977), and the last embracing the Llano Estacado and short grass prairies of North-central Texas.

This view of the conjoination of two, maybe three, Paleoindian catchments, or territories, in the Upper Sabine Valley promotes the following hypothesis. The Paleoindian presence in East Texas-West Louisiana represents the activities of small groups of hunters whose home bases lay some distance away from the Upper Sabine country. Attendant to this hypothesis are corrollary considerations. Resident Paleoindian populations were small or nonexistent. Visiting hunting parties were small and highly mobile; their activities were tightly scheduled and intricately geared into the natural ecosystems of the game being sought. These early visiting hunters established a pre-adaptive mold, an experimental frontier, which facilitated subsequent settlement of Late Paleoindian and Early Archaic peoples in the region.

This reconstruction of East Texas Paleoindian adaptation seems to run counter to Shafer's (1977:187-188) proposal that East Texas was occupied by resident Paleoindians who were following a foraging

(i.e., hunting and gathering) adaptive strategy in contrast to a big game hunting strategy such as was employed in the plains and prairies. Shafer's thesis is based on Bryant's peleoenvironmental reconstructions (Shafer 1977; Bryant and Shafer 1977) which show vegetational succession patterns from 16,000 to 5400 B.P. Actually Shafer's Paleoindian foraging model was predicated on archeological data from Central and East-central Texas, not East Texas per se, where data are less numerous. Shafer (1977) makes the point that mixed deciduous woodlands, such as have covered East Texas since 16,000 B.P., are not the kinds of areas favored by grazing, herding animals. He also acknowledges that climatic fluctuations during the terminal Pleistocene could have resulted in the advance and retreat of savanna-prairie conditions in the woodland ecotone; conditions which might have drawn true Paleoindian big game hunters into the woodland fringes. But the underlying theme of Shafer's model is that the East Texas mixed deciduous forest would have been ecologically more conducive to a hunting and gathering adaptive strategy, not one focussed on big game hunting.

The differences in the present reconstruction and Shafer's are not really as extreme as they might appear. Shafer's view is built of a more holistic, or synchronic, fabric than the alternative model, which is a diachronic one. Both views recognize that East Texas ecosystems during Paleoindian times would have been more favorable to small game hunting-gathering adaptative systems. Another commonality is the belief that contemporary but distinctive adaptive systems can exist side-by-side and that technologies may be rather peculiar to each. But here compatibility ends.

Shafer's model assumes an indigenous, resident, Paleoindian population in East Texas. The present perspective holds that East Texas Paleoindians were mainly transient hunters, but it does not foreclose the possibility that living here and there were small pockets of established pioneers. Shafer's model, reacting to the traditional picture of Paleoindians as rather exclusive big game hunters, rightly argues that such an adaptive strategy would not work well in oak-hickory-pine biocenoses. However, just because a focal big game strategy might not be completely adaptable to the East Texas-West Louisiana woodlands, does not mean that big game hunting was not conducted. Johnson's (1977) information on Paleoindian foods, even among groups whose economic orientation presumably centered around large game, indicates that a much wider variety of exploitative activities were undertaken than had been traditionally assumed. Shafer's "either-or" view of East Texas adaptive strategies fails to recognize the variety in Paleoindian economic activities and that adaptive strategies, no matter their nature, are integrated with the ecosystems of the plants or animals being exploitated not with the environment per se.

Historical accounts indicate that buffalo (Bison bison) inhabited the southern forest country in considerable numbers (Lowery 1974:502-505). Part of the so-called, southern herd actually wintered in southeastern Louisiana near the Mississippi River and ranged freely across Louisiana and Texas (cf. Lowery 1974:501-502). Although certainly never as abundant in Louisiana and East Texas as in the plains (Lowery

1974:504). small to moderate size herds were supported by the grasses on the forest floor and in the small, dispersed prairies. Their annual migratory patterns (southerly movement during autumn-winter, northerly during spring-summer) covered distances of 320-650km; migration routes were easily recognizable by deeply worn trails (Jackson 1961), many of which were later followed by early traces and roads.

This seeming aside on historic bison in the region is presented as an argument supporting similar conditions during terminal Pleistocene times. If the behavior of Pleistocene bison resembled that of modern animals, then there would seem to be little reason to doubt that small bison herds, and perhaps other grazing species, moved back and forth through the East Texas-West Louisiana region. Although lacking hard information on carrying capacity and biomass, there seems to be small doubt that Late Pleistocene and Early historic game conditions were comparable and that local populations were sufficiently numerous to warrant exploitative attention from Paleoindian hunters.

The proposed transient nature of Paleoindian presence in East Texas-West Louisiana would merely be a function of adaptive scheduling and the seasonal availability (due to annual migrations) of herding animals. There are ethnohistorical analogies which can be used as supporting examples. The Hasinai Caddo, who occupied the East Texas region during early historic times, made annual winter treks to buffalo wintering grounds. Two different organizational strategies seem to have determined the size and composition of the hunting party. Among the Nasoni and Nacogdoches, the hunt seems to have involved everyone, villages simply packed up and moved (Griffith 1954:114). The Hasinai proper and the Neche, on the other hand, left some individuals behind to maintain the village (Griffith 1954:114). However, there are strong suspicions that these mass winter movements may have been enabled by the horse. Among contemporary tribes in Louisiana which lacked the horse, winter buffalo hunts were practically exclusive male activities (Swanton 1911). While at the winter hunting grounds, the Caddo dispersed into make-shift camps, and hunting and game preparation seem to have been carried out by individuals, single families, or small groups of several families(Griffith 1954:114). Joutel described a Hasinai buffalo camp in 1687 (cf. Griffith 1954:114) as consisting of three shelters which housed about 15 men, women, and children; he was told by a Hasinai hunter that it was their custom to scatter into small camps in order to improve their chances of taking game (Griffith 1954:114)

The implications of this Caddoan winter hunt strategy for East Texas Paleoindians are rather clear-cut. Migrations of Pleistocene herbivores, particularly ungulates, to southern wintering grounds would have furnished the primary adaptive scheduling criterion. Winter ranges were geographically fixed, thereby providing predictable and well recognized points in space. Winter ranges would have massed the animals, providing increased biomass and thus greatly amplifying the chances of hunter success. Tapping into the annual migration patterns while herds were on the move would appear to have been far

less efficient, because of animal dispersal and body leanness. While the suspected scattered and isolated nature of prairies in the East Texas-West Louisiana woodlands might have contributed to herd breakup, this would only seem to have heightened hunter success by avoiding widespread stampedes and minimizing the opportunities for the gregarious animals to acquire and exhibit defensive behaviors. Additionally even if small herds were driven from their prairie into the surrounding woods, it is likely that they would have quickly reassembled and returned to their favorite pastures.

All in all, the ecosystems of Pleistocene herbivores and the probability that an aspect of Paleoindian subsistence (likely only a seasonal subsystem) was integrated with them could account for the archeological record of East Texas-West Louisiana Paleoindians quite adequately. Annual winter trips from familiar home territories (catchments) to game wintering grounds explains why the majority of the lanceolate projectile points are made of exotic flints. Raw materials were simply acquired within home base ranges, transformed into needed tools, and carried with hunting parties to wintering grounds. Is it simply coincidence that the sources of Paleoindian industrial raw materials just happen to occur within 300-600km distances from the Upper Sabine Valley, the same distances ranged over by migratory herding animals? No, this may be the source of the territorial (catchment) size regularity mentioned previously. Herd behavioral patterns and grasslands distribution in the East Texas-West Louisiana woods could also account for the scattered, isolated finds of Paleoindian projectile points. Hunting losses and temporary camp residue seem to fit this pattern perfectly. Under expectations (cf. the Hasinai winter buffalo hunt model), small camps where all material cultural baggage was portable and essential to the specialized activities being performed would have been carried away, along with the stores of dried meat, when parties returned to home bases after the winter hunts. Little evidence of such temporary utilization should remain, little does.

The present reconstruction of Upper Sabine Valley Paleoindian adaptation accounts for a larger share of the archeological record than previous interpretations. Whether right or wrong, wholly or partially, remains to be decided. It does, however, have testable dimensions.

Diffuse Adaptations Continued: Epipaleoindian

According to Bryant and Shafer (1977), postglacial conditions brought to Texas, particularly to East Texas (Shafer 1977:187) a reduction in mixed, deciduous woodlands in favor of grasslands and scrub-oak savanna communities, until vegetation patterns approximating those of today were reached about 5400 B.P. The admittedly spotty pollen record on which this pattern of succession is based (Bryant and Shafer 1977:15-19) suggests higher evaporation rates or reduced rainfall or both. The extreme eastern portion of East Texas, including the Upper Sabine Valley, was probably largely buffered from these drying out

conditions (cf. Shafer 1977: Figure 2), as it is at present. Shafer (1977:Figure 2) does, in fact, recognize the continuance of mixed, deciduous woodlands in East Texas, as least as far west as the Sabine headwaters, between 10,000 and 6000 B.P. However, the climatic regimes which resulted in the warmer, drier conditions west of the Upper Sabine Valley seem to have had an opposite effect on extreme eastern Texas. This region, already characterized by more abundant rainfall, seems to have received even more significant amounts until around 6000 B.P. Bernard (1950) and Saucier 1974:19) attribute this to successive pluvial intervals, between 25,000-6000 B.P., characterized by heavy, warm season precipitation and cool, dry, windy winters. Perhaps, augmented by the drying out conditions to the west, drainages, such as the Sabine and numerous other eastern watersheds, began to accommodate vastly increased amounts of runoff (Gagliano and Thom 1967; Saucier 1974). As a result, the Sabine River and other similar streams, swelled to gigantic sizes and alluviated their floodplains to levels some 3.0 to 5.0m higher than contemporary alluvial plains. The consequence of these conditions, which geomorphologists refer to as Deweyville (cf. Bernard 1950; Gagliano and Thom 1967), was the construction of intravalley terraces (floodplains) bearing stream channel morphologies three to six times the magniture of current master stream dimensions. Hydrological calculations indicated that Deweyville streams had bankfull discharge capacities increased five to seven fold over modern streams occupying the same drainage system (Gagliano and Thom 1967).

Deweyville floodplains and river channels are clearly identifiable in the Upper Sabine Valley (including the present project area) as terrace inliers and large channel features in various stages of filling from backswamps to clay plugs. In fact, large stretches of Big Sandy Creek, the present underfit master drainage artery within the study area, are controlled by the older Deweyville floodplain morphology.

While Deweyville conditions seem to have been cyclical, resulting in at least two (Sherwood Gagliano, personal communication, 1978) and probably several more, unrecognized, depositional episodes, the final period of Deweyville activity has been placed between 8500-6000 B.P. (Gagliano, noted in Brassieur 1978:68). This coincides with the cultural historical interval, normally referred to as Early Archaic (Epipaleoindian and Early Archaic in the present report).

In order to develop the implications of Deweyvillian conditions as they relate to regional cultural adaptations, it is necessary to examine the archeological data base for the proposed time period. This examination will be rather curt for archeological data are again quite limited, and perceptions of the data are hampered by a complete lack of temporal control and general nonuniformity of observations on the data corpus.

On the basis of artifact assemblage composition, more than any other factor, the post-Pleistocene cultural adaptations of East Texas and West Louisiana have been separated into an Epipaleoindian stage and an Early Archaic stage. There is some empirical support for this separation. The John Pearce site, located in Caddo Parish, Louisiana,

some 110km east of the Big Sandy Creek drainage, illustrates an artifact assemblage characterized by San Patrice and side notched projectile points and a variety of microlithic flake tools, "uncontaminated" by Early Archaic elements (Webb et al. 1971). The stylistic and technological similarities of the Pearce chipped stone complex and earlier Paleoindian assemblages (cf. Irwin and Wormington 1970) justifies, in this author's opinion, the application of the term, Epipaleoindian, to this assemblage. It must be emphasized, however, that this rubric connotes absolutely no more than resemblances in stone technology. As will be suggested later, adaptive patterns--procurement strategies and economic catchments--of full-fledged (earlier) Paleoindians and Epipaleoindians were probably quite distinctive. The dominant assemblage of this Epipaleoindian stage is the so-called San Patrice complex (cf. Webb 1946, 1948; Webb et al. 1971).

Acceptance of this two part breakdown of early post-Pleistocene adaptations may not be without resistance. Rare as a hen's tooth are those relevant sites (excepting John Pearce) which show a clear separation (stratigraphically, horizontally, or single componentially) between the San Patrice complex and presumably later assemblages dominated by expanding stem projectile points, diminished numbers of small flake tools, and increased numbers of larger bifacial and ground stone tools (the latter recognized herein as Early Archaic). The Yarbrough site in the Upper Sabine Valley (Johnson 1962) and the Jake Martin site in the Cypress Creek drainage (Davis and Davis 1960), both near the Big Sandy Creek locality, exhibit San Patrice (and Meserve) points and small, unifacial tools mixed with presumed Early Archaic materials in the same basal stratigraphic levels. A list of sites producing surface finds of San Patrice points in northwestern Louisiana (Webb et al. 1971) also shows mixtures with expanding stem industrial elements. A similar situation seems to obtain further south along both sides of the Sabine River, where several sites exhibit both San Patrice and expanding stem projectile points (Jensen 1968a; Duffield 1963; Jelks 1965; Gregory DuCote and James Morehead, personal communication, 1978). As a matter of fact, the same "mixed" assemblage would have been evident at John Pearce if only the surface materials or the excavated materials from the plowed field had been available.

Webb et al. (1971) intimates that the "mixed" nature of these early assemblages are a result of the effects of bioturbation, plowing, and archeological excavation by arbitrary, rather than natural, levels in the usually shallow cultural deposits of the time span. Where deeper deposits occur and/or where such disturbing activities have not transpired, such as in Area B at the John Pearce site (Webb et al. 1971), "unmixed" assemblages have appeared or may be anticipated. In this sense, Webb and colleagues recognized, without formalizing, the Epipaleoindian vis-a-vis Early Archaic dichotomy advanced in this report.

Recognizing a technological and stylistic continuum in stone artifacts from Paleoindian to Epipaleoindian times is a far cry from recognizing an unchanged adaptive tradition in East Texas and West Louisiana. Sheer numbers of San Patrice complex artifacts and the

multiplied increase in sites bearing these elements speak to expanding populations or heightened mobility of a small, but by now, resident population nucleus. As will be presently argued, larger populations, by this time become resident, is the favored interpretation of the Epipaleoindian archeological record. The very same source of the problems providing difficulties in separating Epipaleoindian from Early Archaic complexes is responsible for the wholly argumentative nature of Epipaleoindian adaptive strategies and catchment reconstructions. That source, to wit and totally unconfirmed, is thought to be the limited time span of the San Patrice complex; not the two millennia duration suggested on extraregional, radiocarbon dating grounds for stylistically similar complexes, but a span more likely limited to a few centuries and those probably compressed into the very earliest part of the presumed lengthy transitional interval.

The changing ecological regimes brought on by Deweyville conditions presented both distinctive economic opportunities and limitations to those pioneers living on the fringes of the expanded frontiers which now embraced East Texas and West Louisiana. How do we know that populations were now residing in the region in greater numbers and were more limited in terms of ranges (catchments) than previously? The principle of least effort and the catchment approach itself helps us respond to this question, which must be satisfactorily addressed before proceeding with reconstructions of Epipaleoindian adaptive strategies.

There is an absolute dearth of direct evidence of Epipaleoindian foodstuffs and industrial resources, aside from rocks, in East Texas-West Louisiana. Therefore, the entire weight of defining Epipaleoindian economic catchments falls on industrial resources, and this source of information is very revealing. The sources of San Patrice industrial materials are almost entirely local. The vari-colored pebble cherts, petrified woods, orthoquartzites, sandstones, and ironstones which comprised the lithic resources of the San Patrice complex (cf. Davis and Davis 1960; Johnson 1962; Webb et al. 1971) are all indigenous to the hill country of East Texas-West Louisiana. Exotic materials which figured so prominantly in earlier Paleoindian technology do not occur, or appear in such isolated cases that reuse of older archeological materials or the exceptional example in regional gravel outcrops could easily account for the rarity. This observation contrasts markedly with the Paleoindian situation in the region where 50 percent (usually more) of the stone tool assemblage was rendered of exotic materials. The Miocene rocks, e.g. sandstones, orthquartzites, petrified woods, and ironstones, and Miocene-derived precipitates (opals, GMC quartz , orthoquartzites, hard carbonates, etc.), as well as the abundant, alluvially transported Early Pleistocene gravels, are practically ubiquitous across the region; various localities differing mainly in quantities of these resources rather than in simple presence of absence.

The omnipresence of these lithic resources and the nearly exclusive utilization of them by San Patrice folks is viewed as indubitable evidence of exploitation by regional, resident populations, not specialized groups simply passing through the area in route to and

from extra-territorial home bases and game wintering grounds. Yet in the regional ecosystems produced by late Deweyville conditions were selective pressures which helped shape adaptive strategies and define economic catchment zones of Epipaleoindian inhabitants.

Many of the technological and stylistic differences between Paleoindian and San Patrice chipped stone elements seem directly related to flaking quality and nodule size limitations inherent in the local stream gravels. Otherwise, there is really little doubt, for at least several centuries following the "disappearance" of lanceolate Paleoindian projectile points, that typical Paleoindian industrial traditions were maintained, not only in projectile point manufacture but continued in other elements of the small flake tool assemblage as well. However, there seem to have been constraints in that slowly evolving, traditional, chipped stone industry that hampered acceptible responses to the ecological pressures of the East Texas-West Louisiana frontier. The ultimate result of this technological revamping was the development, in situ, of reconstituted tool assemblages, widely recognized as Early Archaic. Before examining the Early Archaic conditions, let us briefly review the Epipaleoindian, San Patrice adaptation because it represented the first, really significant cultural remodeling in the Upper Sabine Valley, the first at least predicated entirely (if this author's previous model of transitory Paleoindians has any merit) on indigenous ecosystems.

If the climatic and hydrological inferences about Deweyville conditions (based as they are on pollen and geomorphic data) are correct, then the Upper Sabine Valley and innumerable tributary drainages and similar watersheds, in and along which San Patrice sites are concentrated, were quite different during that period than in either the immediately preceding or postceding intervals. In terminology become very popular recently, the Deweyville regime in the Sabine watershed created drastic shifts in total energy flow and energy subsidies and dramatically increased the kinds and amounts of edge (cf. Odum 1971: 40-52, 157-161). In contrast to the Lateglacial period (Bryant and Shafer 1977), there would have been a decided, perhaps quantum, jump in the extent of aquatic vis-a-vis terrestrial biocenoses. As aquatic, semi-aquatic, and marginal aquatic environments expanded at the expense of purely terrestrial ones, adaptive strategies and economic catchments would have shifted to meet the redirected energy flow through floodplain and upland borders ecosystems. Not only were the energy flow patterns changed by expansion of one biocenose and reduction of another, but the rates of flow and augmenting surpluses (i.e., subsidies) were changed throughout the annum. Instead of the current cycle of spring overflows, summer low water, and gradual winter rises, the hydrological regime in Deweyville rivers may have reversed the pattern, creating summer overflows and winter lows. The impact on terrestrial fauna and flora of the floodplain floors could have been pronounced, perhaps promoting vegetation successional patterns and climax conditions considerably out of phase with those of recent annual and long-term cycles.

Deweyville ecological changes would not have been limited to floodplain environments. Floodplain edge and adjoining upland biocenoses would have been affected as well, as significantly increased runoff due to heavy summer rains hastened sheet and gully erosion. The erosion and resultant loss of plant cover may have been a primary agent in contributing to the present-day hilly morphology of East Texas and West Louisiana. In economic catchment terms, however, the runoff-erosion process would have greatly increased the amount of edge, expanding biotic variety and density (Odum 1971:157), a boon to hunters and collectors. The edge effect would have probably been most pronounced along the tension zones between biocenoses, such as where floodplains met valley walls, but would have been marked still within biocenoses (e.g., upland ravines, hill slopes, headwaters of steep gradient branches, and erosionally razed flats, etc., as well as around colluvial fans, stream confluences, better drained-poorly drained borders down in the floodplain, etc.).

If these environmental reconstructions even remotely resemble Deweyville conditions and if Epipaleoindian (San Patrice) adaptations are correctly correlated with this regime, then a tentative model of economic catchment and resource procuration strategies may be set forth. Webb et al. (1971:44) states that San Patrice sites occur in two different kinds of natural settings: a) along the valley wall margins overlooking major stream valleys (i.e., superior rank order streams) and b) out in the uplands along minor branches and runs. The lack of intensive investigation at these sites prohibits determinations of assemblage composition differences (cf. Webb et al. 1971:44), although they are certainly suspected. Utilized raw materials are local, and by extension, so were foods and other essential resources (although direct evidence is entirely lacking). In other words, Epipaleoindian (San Patrice) catchments areas are believed to be totally localized and considerably smaller than those of preceding Paleoindians, even with regard to lithic resources. San Patrice populations were resident and somewhat larger than population nuclei in the heart of Paleoindian catchments. Although considerable variability should perhaps be expected, a solitary ideal catchment model can be set up to accommodate the anticipated diffuse nature of Epipaleoindian adaptation and its settlement correlates.

Ideally, a San Patrice catchment zone can be placed over a geographic (paleogeographic) territory which has near its center a maximum amount of edge and within its outer radial bands all manner of supportative hinterland resources. Since operationally, the catchment approach works by dint of a mini-max principle, centering a San Patrice catchment on a spot where natural energy flow and energy subsidies can be most easily intercepted and redirected into human maintenance, given a particular level of technology and a hunting-gathering strategy, would seem to have enabled most efficient adaptation. Such placement would have insured that the lion's share of culturally sustaining resources--industrial and food--were available at or close to the population center. In terms of economic potential and least danger of peoples unsetting natural energy flow patterns, San Patrice catchments could have maximized East Texas-West Louisiana hill country

environmental productivity by centering their ranges at locations where natural biotic diversity was greatest and biomass densest and where energy subsidized ecosystems were conjoined, or in terms of Upper Sabine Deweyville conditions, at places where upland margins joined floodplain edges. Not only would these tension zones (edges) have provided maximum exposure to a variety of useful plants whose natural habitats overlap in such localities but human activities along these stretches would likely have fostered their propogation and spread. Disturbances around residential or occupational areas promote invasion of heliotrophic (sun-loving) plants, which as an aggregate is one of the most economical sources of natural foods. Proximity to floodplain edges (aquatic environments) would have also placed at ready disposal, one of the most productive, self-maintaining, continually replenishing ecosystems in the region. Energy subsidies in lotic, or running water, communities (Odum 1971:316) are among the highest in nature. Adaptive implications of lotic ecosystems reside, not only in biomass, but in the capacity for rejuvenation and augmentation on a seasonal cycle. In other words, the large numbers of economically useful plants and animals, native to this ecosystem, are not only sustained and continually replenished by systemic energy flow, but the endemic community becomes swollen with nonresident, migratory fauna, particularly waterfowl, during the fall and winter. Useful biota in the lotic community are particularly amenable to hand-gathering or unmanned, capture (energy-restraining) devices. Terrestrial (upland) fauna are both repulsed and attracted by human activities, but the suspected small degree of environmental modification by San Patrice folks would seem to have led to more repulsion than attraction. Therefore more cultural energy would have had to be expended to secure upland game resources, but the high initial investment (cf. Earle 1980) was apparently balanced by the high caloric return when large animals were killed. Large animals by this time, are, parenthetically, those native to East Texas today; the Pleistocene megafauna were extinct. Because initial high energy outlays were adaptively tolerable in the hypothesized San Patrice economic strategy, there would have been ecologically no advantage in moving residential locales to areas of highest upland game densities. Such an adaptive alternative would simply not have worked because of game repulsion. Additionally, if edges, so favored by deer and other smaller mammals, were as dramatically increased in upland biocenoses as the erosional Deweyville conditions would seem to indicate, then game biomass would not only have been high but would have probably been well distributed across catchment zones.

Therefore, the distribution of San Patrice sites within the two primary environmental settings (cf. Webb et al. 1971) seems to be a perfectly logical means of adapting populations and their residential and occupational nodes to the ecosystems and their geographic distributions embraced by the hypothesized catchment model. Settlement correlates of the suspected San Patrice adaptive strategy would take the form of rather centralized base camps, where families resided, surrounded by special activity camps and stations near high yield resource points more than a single day walk from base camps.

Actually in these general terms, the San Patrice model does not differ in kind for any of the ensuing diffuse adaptations in eastern Texas and western Louisiana. Early to Late Archaic, as well as Pre-Caddoan, manifestations should all be theoretically expressed under the Epipaleoindian adaptive model. However changes in the economic and settlement strategies of these ensuing adaptive systems are to be expected if for no other reason than to accommodate endemic population growth. Catchment areas may have expended or shrunk in size as populations grew, as technological innovations occurred, or as some resources perhaps came to be emphasized over others, but the diffuse model of Epipaleoindian adaptation should provide a general framework for evaluating the potentially variable strategies deployed by these more recent, nonhorticultural residents of the Upper Sabine Valley.

Later Diffuse Adaptations: The Archaic Continuum

The perspective of economic adaptation enables one to view post-Paleoindian, pre-horticultural societies in the East Texas-West Louisiana region as a long, basically unchanging continuum; a continuum, which for want of a better term, will be referred to as Archaic. Since the meaning of Archaic as used here differs somewhat from its traditional application in the area, the archeological complexes embraced by it are identified as follows: a) East Texas (Suhm, Krieger, and Jelks 1954:148-151), Red River (Webb 1960:27-48), and LaHarpe (Johnson 1962) aspects, virtually synonomous names for an undifferentiated, pre-pottery stage; and b) Fourche Maline (Bell 1980), Pre-Caddoan (Fulton and Webb 1953; Davis 1970:38-39), and recently "Formative" (Davis 1970:38-39) and "Woodland" (Shafer 1975:249-254), terms embracing somewhat similar manifestations that yield early, non-Caddoan pottery. The grouping of all these units into a common Archaic continuum is simply acknowledgement that a nonhorticultural, hunting and gathering subsistence base may have underpinned them (cf. Willey and Phillips 1958:107). The grouping is not predicated on material cultural content--similarities or differences--which have provided the typological criteria for traditionally separating Archaic from later complexes. As a matter of fact, one class of artifacts has been nearly exclusively used to mark the division between Archaic and subsequent cultures throughout the Caddoan area. That singular class of material--pottery--has probably been far more significant to archeologists than it ever was to the operations of the cultures who produced it. The usual equation of pottery with horticulture (cf. Johnson 1962:268) is outmoded and incorrect, as was recognized some time ago by Davis (1970:37-38), and if pottery, as an introduction or innovation, caused any kind of drastic cultural remodeling, it has yet to be recognized.

Consequently, other than the presence of ceramics (non-Caddoan) in the so-called Pre-Caddoan manifestations, they seem to be generally of the same adaptive mold as the traditionally recognized Archaic cultures.

As Story (1976) recently concluded, there has been little gain in understanding East Texas Archaic since Webb's (1960) review. The major focus of concern has been, and continues to be, on stone artifacts, particularly projectile point types, and on the historical implications of types, i.e., ages and geographic distributions. Even historiography has not been as successful as desired because of the general lack of excavations and the shallow, compressed, and often churned stratigraphy of the sites which have been excavated (cf. Davis and Davis 1960: Johnson 1962; Scurlock 1962). Other complications that have plagued sequencing of East Texas Archaic continua have been methodological. The Archaic sequence lacks a sound radiocarbon framework. The nearly single-minded adherance to an historic type approach has not only resulted in the neglect of technological and processual perspectives (Shiner 1980) but, until recently, actually conditioned artifact recovery itself. Artifacts, for example, came to be synonomous with tools. Consequently in sites, like Martin (Davis and Davis 1960), Yarborough and Miller (Johnson 1962), and Culpepper (Scurlock 1962), near the present study area, lithic debris and debitage were not retrieved unless they showed evidence of tool modification.

Thus, the Archaic sequence in East Texas is a projectile point sequence with a few other tools thrown in where stratigraphically associated. Johnson's (1962) phase outline for the LaHarpe Aspect furnishes the major comparative historical framework for East Texas-West Louisiana Archaic development. Johnson recognizes three major Archaic divisions: a) Early LaHarpe, dominated by expanding stem projectile points; b) Late LaHarpe, characterized by contracting stem points and the appearance of pitted stones and a few other ground and polished stone artifacts; and c) Terminal LaHarpe, signaled by a continuance of the so-called Gary assemblage (typically the smaller varieties, cf. Shafer 1975) to which plain ceramics are added (Johnson 1962:268-269).

This outline is adequate in general, but it should be mentioned that Johnson's supposed plain pottery interval (Terminal LaHarpe) is simply a function of limited data (cf. Gibson 1978:28). Since the present concept of East Texas Archaic development is given to adaptive similarities, not to shifts in projectile point types or the appearance or disappearance of other artifact classes, the Archaic continuum is extended to include those later manifestations commonly referred to as "Pre-Caddoan".

As previously mentioned, the adaptive model established for the Epipaleoindian interval seems amenable to the entirety of the Archaic continuum, prior to the assimilation of maize horticulture. This presumed continuity is based on ecological arguments and on certain archeological data. In this author's opinion, it is no simple coincidence that every known San Patrice site has produced Early Archaic and often later Archaic materials (Webb <u>et al</u>. 1971). Archaic sites thus occur in the same environmental positions as Epipaleoindian ones but since there are numerically more Archaic than San Patrice sites, they also occur in locations where San Patrice components are not found. Following this line of argument, the longevity of occupation or the

repetitiveness of occupation at Archaic sites implies that the same geographic locations continued to furnish advantageous bases of operation, well into the last half of the first Christian millennium.

While it is tempting to infer an arithmetic (perhaps geometric) increase in numbers of Archaic sites, as well as a growing sedentism throughout this long period, to do so is not necessarily correct. Such trends seem apparent from the scanty East Texas-West Louisiana data, and they are certainly commensurate with suspicions of population growth and increasing economic efficiency. Yet numbers of sites are directly related to economic strategies and sizes of catchment areas, as well as population density. A group of 10 people moving every few weeks within a catchment zone characterized by extremely diversified, widely distributed resources of approximately equal value would leave far more sites than a much larger group exploiting fewer, higher yield resources of more restricted distribution. Similarly an adaptive strategy which integrated a village-base camp nucleus with specialized, short-term activity camps more than a day's distance away might leave more sites than a strategy involving atomized base camps which shifted with the changing seasons. Such strategic models have actually been used to "explain" the high incidences of presumed Archaic sites along the middle and lower reaches of the Sabine Valley, a region thought to have low population densities throughout prehistory (Gibson 1978). Thus simple numbers of sites cannot be regarded as a sure-fire indication of population numbers, and until archeological methods become more finely honed to permit the separation of long, reoccupied base camps vis-a-vis sedentary villages, simple sizes of sites or depths of cultural refuse will continue to be of little aid in inferring population densities or residential stability.

To model Upper Sabine Valley Archaic strategies and catchment zones based on suspicions of increases in population and sedentism would far exceed factual support. Therefore, the Archaic adaptive model will be a general one, capable of accommodating various economic strategies but still specific enough to offer predictive possibilities in the Big Sandy region. It should perhaps be pointed out that, in the argument developed above for Archaic continuity, mention was made of the identity of Archaic and Epipaleoindian site locations, i.e., found in the same environmental situations. This should not be taken to mean that the ecological conditions at those locations have remained constant throughout postglacial time, nor that a static view of East Texas paleoenvironments is being adhered to. This is a critical point, and justification for the applicability of the Epipaleoindian adaptive model to subsequent Archaic cultures hinges on resolving the apparent contradictions and seeming conflicts of presumably significant paleoenvironmental changes between the San Patrice and Early LaHarpe intervals.

The San Patrice climax apparently transpired endemically in eastern Texas-western Louisiana in response to Deweyville pluvial conditions, which fostered an energetic aquatic ecosystem within stream floodplains and produced considerable edge conditions in and

along the margins of the uplands. Pollen information (Bryant and Shafer 1977) and geomorphology (Gagliano, cited in Brassieur 1978) suggest that around 6000 B.P. (5400 B.P., according to Shafer 1977) these conditions had ameliorated, and East Texas-West Louisiana began to assume an environmental character similar to that of the historic present. If we are to presume that the Epipaleoindian model also applies equally well to the Archaic adaptive systems that followed this paleoenvironmental remodeling, then we must contend with the ecological changes resulting from this shift.

The argument takes its lead in factual information which indicates that ecological patterns changed quantitatively, not qualitatively. Bryant and Shafer (1977) have, for example, placed East Texas in a special vegetation band during both lateglacial and postglacial intervals. Except for the likelihood that certain species may have become extinct or simply "moved" northward, East Texas was largely immune to the extreme biotic replacements transpiring to the west. East Texas was, and continued to be, dominated by a mixed deciduous biotic community. The end of late Deweyville rainy-runoff conditions did not result in the drying-up of rivers and streams, only a reduced capacity for energy transmission within floodplains. Little, if any, significant modifications can be envisioned for the uplands (hills) biocenoses. Deweyville dissections (i.e., the environmental edges) were almost certainly claimed by climax hardwood stands, which pine rarely displaces, unless fire-aided. Vegetation zonation, however, may have become more abrupt as pines perhaps crowded out hill top and hill slope hardwoods, except for the hardy, tenacious scrub oaks.

In substantial sum, the post-Deweyville environment in East Texas underwent change in energy flow characteristics, particularly within drainage ecosystems, but remained basically a diversified, mixed deciduous zone with plenty of edge situations; the latter, perhaps, became more strongly zoned by plant succession-climax processes (cf. Odum 1971: 251-263). It is this argument then that supports the applicability of the San Patrice adaptive model to Upper Sabine Archaic situations prior to the adoption of a horticultural subsistence base. Whatever was happening adaptively during the Archaic span was simply more or less of what was transpiring during Epipaleoindian times; differences were not in kinds.

Thus where surveys have been fairly comprehensive in the general region, such as Lake Fork Creek (Bruseth et al. 1977), Toledo Bend (Scurlock and Davis 1962; Scurlock 1964; Ben[illegible] Miller and Sciscenti 1973), Lake O' The Pines (Davis and Davis 1960), Middle and Lower Sabine Valley (Gibson 1978), Livingston Reservoir (McClurkan 1968), and Lake Palestine (Anderson 1972), Archaic sites show a decided affinity for sandy ridges or knolls located along tension zones (narrow ecotones), either within the floodplain proper (old Deweyville surfaces, not modern levels) or along their junctions with the confining hills (cf. Shafer 1975:249; Gibson 1978:27). However, Archaic sites are probably not restricted to these kinds of locations. Nearly all of the survey data, cited above, are biased in the sense that they are resultant from contract investigations which were strictly limited by

the flood pool levels of planned reservoirs or by the impact limits of other waterway projects. In simple terms only floodplains and basal elevations of flanking uplands were surveyed; adjoining hills--outside the zone of construction impact--were not investigated. Thus the most comprehensive data available is not comprehensive enough to determine if Archaic sites are actually missing along the tiny perennial and intermittent branches in the hills, or if the known settlement pattern is an artifice of contract restrictions. This author favors the latter probability. Such sites were found in the edges of the hills flanking the Middle Sabine River, below Toledo Bend (Gibson 1978); here this settlement form was specifically sought despite its marginal location outside zones of primary waterway impacts.

Thus the limitations of available data are viewed as just that--data limitations. Those little Archaic sites are no doubt present in the hills bordering major floodplains in the Upper Sabine locality. Because of this conviction, the two settlement distributions embraced by the San Patrice adaptive model, i.e., the valley margin components and the interior hills drainage components, are also thought to be present in Archaic, further justification for the applicability of a common adaptive model for both adaptive patterns.

What is known of resource uses by Archaic groups in the region is, with few exceptions, limited to nonperishable, lithic materials. Stone resources are overwhelmingly local, vari-colored pebble cherts, petrified wood, quartzites, ferruginous sandstone, etc. Novaculite, an exotic from Arkansas, appears in some assemblages, but percentages are always insignificant. For example, among dart points at the Yarborough site, it represents 0.5 percent (Johnson 1962). This tends to lend additional support for Epipaleoindian and Archaic compatibility, by indicating that catchments of both adaptive systems were centered in the region and did not extend to exotic industrial resource locations.

There are a few data that seem to indicate either a slow general increase in exotics or else a limited trade acquisition of nonlocal materials during the waning throes of the Archaic adaptive system. In a select number of sites, which coincidentally or, as this author suspects, more relevantly, exhibits ceramics of Lower Mississippi Valley styles or other artifacts whose stylistic "hearths" fall outside East Texas-West Louisiana, there appear higher incidences of nonlocal raw materials. The Resch site, near Marshall, produced a quartz crystal, galena, and 13 percent novaculite and Central Texas flints among chipped artifacts (Webb et al. 1969). Also present were a few potsherds of Lower Mississippi Valley styles, e.g., Tchefuncte, Marksville, Troyville, and Coles Creek (Webb et al. 1969:32-39), mixed with more "typical" sand, bone, and clay "tempered" ceramics. Coral Snake Mound (McClurkan, Field, and Woodall 1966; Jensen 1968a, 1968b; Gibson 1970a)at Toledo Bend, Jonas Short Mound at Magee Bend (Jelks 1965; McClurkan, Jelks, and Jensen 1980), and several sites of the Bellevue complex (cf. Fulton and Webb 1953) also show these small but consistent percentages of exotic materials. Except for Resch, all of

these sites represent specialized precincts, given to mound-building, burial, and ceremonial "consumption" of exotic materials and honoric artifacts. In this sense, they are atypical in the more practical meaning of the concept of catchment area. This is not to say that they are atypical of the local adaptive systems which produced them, only that the large share of exotics and the specialized artifacts made of them were slated for funerary disposition, not for more "mundane" roles in subsistence activities. Such exotics are still amenable to examination under a catchment approach, but it should be made clear that the catchment zones embracing the sources of these materials (or more likely the human resources responsible for their exportation) was rooted in a cultural subsystem which operationally transcended the normal, day-to-day subsistence quest that put food in the pot and tools in the hand. In other words, two distinctive (but probably interrelated) catchment spheres were operative in these Late Archaic adaptive systems; one dealing with the acquisition of foods and general maintenance supplies and materials, the other devoted to the acquisition for more distant, nonlocal materials which served to maintain life-death crisis programs and to validate attendant ideologies and attitudes.

This particular view of certain Late Archaic (Pre-Caddoan) situations in East Texas-West Louisiana has meaning beyond the historiographic contexts in which they are usually discussed. Previous considerations have typically centered on the historical origin of the complex(es), whether imported by migrant Hopewell, Marksville, or Adena peoples or diffused _in toto_ from nuclear centers of these "cultures" (Jelks 1965; McClurkan, Field, and Woodall 1966; Jensen 1968b), or developed in place and selectively assimilated certain sweeping, extra-areal styles, commodities, and cultural practices (Gibson 1970a); McClurkan, Jelks, and Jensen 1980), or on methodological arguments of typology and its implications (Shafer 1975:253; Gibson 1978:30-31). For present concerns, historiographic reconstructions and counter arguments (migration or diffusion _vis-a-vis_ in place development) have no relevance. The thrust here is on adaptive systems--economic strategies and catchment areas. Anything else is peripheral.

To briefly recapitulate, Archaic adaptation in the Upper Sabine Valley represents a general continuum of a pattern first manifested by Epipaleoindians, and the model developed for San Patrice adaptation is anticipated to accommodate the Archaic situations as well. Subsistence was of the diffuse type and was based on hunting and gathering. Economic catchment areas were localized and positioned so as to incorporate food and industrial resources from diversified biocenoses. The minimax principle seems to have been adhered to, as evidenced by incompletely known settlement correlates, which show an affinial relationship of relative site locations and environmental edges. Large camps and small ones are known (and are anticipated) from these edge areas, relative sizes of sites may be directly related to the number of biocenoses bordering on these narrow ecotones. In other words, "strong" edges where a multitude of distinctive biocenoses were joined together (thereby producing considerable biotic diversity) seem to support larger sites. "Weaker" edges (i.e., fewer conjoined biocenoses) harbor smaller (but not necessarily fewer) camps, whose _raison d'etre_ may have been more specialized and limited and of shorter (time-wise) importance.

Adaptation Reorientated: Focal Systems in East Texas

The Development of the Caddoan Tradition

At an unknown time during the first Christian millennium and after an assimilative-"experimental" period of uncertain length, some East Texas-West Louisiana peoples adopted plant husbandry and horticultural strategies into their adaptive systems. The impetus of this significant shift, the reasons why its initial assimilation seems to have been delayed when compared with surrounding regions, whether or not it affected all groups equally and simultaneously, and its relative importance in subsistence, are relevant questions for which we have no answers at present. Notice also that horticulture is said to have been integrated into subsistence pursuits, not to have replaced existent ones. Even into the historic period, Caddo Indians were mixed strategists. Horticulture played a large role, one could even say dominating role, in Caddo economics, but hunting, fishing, and wild plant collecting had not been entirely foresaken. As a matter of fact, during extended periods of the year, foods of the historic Caddo were almost entirely limited to wild species.

However, horticulture based on the maize, squash, and bean complex entailed a scheduling cycle (tilling, planting, tending, and harvesting) that was incompatible with natural biotic cycles (availability) and to subsistence quests integrated with them. In other words, horticulture, which occupies the spring and summer months, requires that wild plants and animals, whose warm weather availability or accessibility underpinned traditional Archaic hunting and gathering pursuits, be neglected or else procured within a tighter scheduling framework, perhaps involving a more rigidified sexual division of labor.

To label those adaptive systems, remodeled by the necessary compensatory readjustments in economy attendant upon the assimilation of maize horticulture, Cleland (1976) has proposed the name, focal adaptations. Cleland (1976:60-61) describes focal adaptations this way:

> . . .specialized focal adaptations . . . are centered on one resource or a few similar resources. . . . , focal adaptations are labor intensive. That is, adaptive strategy dictates that a minimum of the energy available for production be directed towards the single resource or resource complex upon which survival depends. Although excess energy may be diverted to supplement production of other resources, the closer we move towards the minimal energy requirement, the greater the pressure will be to redirect energy toward the security of the focal resource. The adaptive strategy that will provide the greatest security is that which increases the quantity of food produced rather than the variety.

Of course, Cleland's characterization applies to adaptive strategies other than horticultural ones, but for purposes here, it is limited to horticultural situations. Cleland's classification is also compatible with Earle's (1980:1-29) analytical framework of procurement "costs" based on economists' models, as well as Christenson's (1980: 31-72) applied ideas concerning changes in the human food niche. The commonality among these approaches is human energy expenditure as "measured" in terms of initial and marginal "costs". These concepts will be operationalized shortly as they apply to the East Texas-West Louisiana archeological picture.

First, however, there will be an examination of the relevant archeological record, its data base, its classifactory breakdown, and general considerations of the emergent Caddoan tradition. As nearly as can be detected archeologically, the appearance of focal, horticultural adaptations in East Texas-West Louisiana parallels, or coincides, with the emergence of a regionally variable but generally similar package of material cultural things and styles to which the name, Caddoan, is applied. The origin(s) of the material complex is (are) obscure, though it has been the source of debate for years; one position favoring Mesoamerican inspiration (cf. Newell and Krieger 1949): another defending Lower Mississippi Valley (Coles Creek) diffusion (Ford 1952; Webb 1961) or arguing, pro or con, over temporal alinements across Caddoan-Lower Valley areas; and more recently, a third view of Coles Creek-Caddoan continuity rather unconcerned about the origin of Caddoan pottery (Webb and McKinney 1975). Caddoan is the term applied to these distinctive manifestations because the geographic territory covered by these components was precisely the same as was occupied by the Caddo tribes of historic times. In a general way, Caddoan has come to mean something more like a tradition (cf. Willey and Phillips 1958) than a particular culture, or more particularly it is used to embrace a time span covering more than a millennium (ca. A.D. 700-1800) during which several regional cultural groups exhibited similar material cultural complexes that seem to have involved a common style-sharing sphere and that generally progressed along a similar, if not identical, course of development.

In terms of culture unit typology, we are speaking of the Gibson and Fulton aspects, and in terms of basic operational units in the Upper Sabine Valley, of the Alto, "Pre-Sanders", Sanders, "Whelan", Titus, Texarkana, Allen, and Little River foci, or complexes (cf. Davis 1970:40-56; Skiles et al. 1980). In terms of chronology and culture history, we are referring to the Caddo I-V periods, which, from earliest to latest, incorporate the various foci as follows: Caddo I, Alto and "Pre-Sanders" foci; Caddo II, Sanders focus; Caddo III, "Whelan" complexes; Caddo IV, Titus and Texarkana foci: and Caddo V, the historic Allen, Little River, and Norteño units (Davis 1970:40-56). Whether any or all of these typological units will be identifiable on the basis of materials from within the Upper Sabine Valley in general, and from the Big Sandy Creek locality in particular, remains to be determined. Some ethnohistoric and archeological information and interpretations (Swanton 1942; Woodall 1969b, 1980) exist which imply that the Upper Sabine Valley may have been a sparsely settled,

perhaps even vacant, region during protohistoric and historic times. Woodall (1969b, 1980), in particular, points out that the locality, because of certain environmental limitations to horticulture, may have been an unoccupied buffer zone between two regional Caddoan confera-cies, that of the Kadohadocho to the northeast along the Red River and that of the Hasinai to the south along the Neches-Angelina rivers.

Whatever the case, the classifactory units and cultural historical scheme outlined above should provide ample heuristic organization to material cultural remains in the Big Sandy locality. If they do not fit precisely, they still remain a convenient point of departure and a working framework for comparison. While assessment of the "degree of fit" is not a principal objective of this investigation, ideas on material cultural compatability should nonetheless be emergent from field work findings. And if the Woodall thesis has merit and late Caddoan sites cannot be found in the project area, then the Caddoan cultural historical framework will still be useful from a negative point of view.

With schematics aside, we may explore the available physical evidences of foods and other resources and settlement locations as they pertain to adaptive strategies of late prehistoric and early historic Caddo. As with earlier periods, subsistence information is sparce. Part of this sparseness is unavoidably related to poor preservation conditions in the "pineywoods", but there is no doubt an equally large contributor to the lacunae of information--archeological methodology itself. Traditional objectives of East Texas archeological investigations were not given to subsistence reconstructions nor to the small scale recovery of plant and animal remains. Sites were dug before such issues became paramount and before necessary equipment, know-how, and identification expertise became available. This can be most emphatically seen in the kinds of sites that archeologists chose to excavate, i.e., predominantly cemeteries and burial mounds. When habitation locales were investigated, research aims were overwhelmingly devoted to pottery and projectile point classification and cultural historical ends, to the neglect of subsistence objectives. The consequences of the history of East Texas archeology, which incidentally are not confined to the region, are the limited data corpus set forth below.

From the general area under review, archeological data on foods are limited mainly to the George C. Davis site near the Neches River in Cherokee County, Texas (Newell and Krieger 1949; Jones 1949) and to spotly occurrences elsewhere, including the possibly nonrelevant Red River Valley Caddoan sites. The nonrelevancy of Red River Caddoan food resources is argued because of major environmental and ecological differences between the Red and Sabine river valleys. Davis site food remains are a mixture of wild and cultivated plants (i.e., nuts and acorns and maize) and large and small animals (i.e., deer, bison, rabbit, squirrel, tortoise, and mussel (Unio) (Newell and Krieger 1949: 180-181). Other resources included firewood (oak, pine, cane) and entropic resources such as locally available rocks and minerals, as well as materials from areas moderate to long distant from the site.

From ethnohistorical sources on the Hasinai Caddo (cf. Swanton 1942; Griffith 1954), additional food and industrial resources are known. Cultigens included maize (two varieties), beans (five or six varieties), sunflowers, tobacco, and gourds. Other plant domesticates are recorded (e.g., canteloupes, watermelons, peaches, plums, etc.), but these are assuredly nonnative introductions. Chickens and turkeys were also kept but again European influence is likely responsible. Wild plant foods mentioned include acorns and nuts, persimmons, plums and other fruits, a variety of berries, maypops, edible herbs, roots and "ground nuts", and reed (cane?) seeds. Mammals hunted included bison, deer, bear, and wildcats, badgers, and mice (the latter three animals only during "lean times"); birds, turkeys, partridges, quail, prairie chickens, and in proper season, ducks, geese, bustards, and cranes; and fish (indifferentiated species, summer "only").

Other recorded materials (resources) included woods (i.e., mulberry, walnut, cedar, Osage orange, reeds, and canes); stone, flints and red ochre; skins and feathers, deer, buffalo, turkey, and rabbit; bones, crane; and shells (freshwater mussels, unspecified kinds) (Swanton 1942: et passim; Griffith 1954: et passim).

The economic resources known for the East Texas Caddo after A.D. 700-800 were quite diversified and with but a few exceptions were all found in the East Texas area. Extra-areal resources were, in general, important in cultural subsystems other than direct food provision, e.g., ceremonialism and ritual, social status validation, etc. The same argument can be offered in the case of bison, which historical records (Swanton 1942; Griffith 1954) indicate were a nonlocal food resource (winter treks covering considerable distances were made to the plains for these animals). Such a high initial cost (cf. Earle 1980) for obtaining bison almost certainly indicates that the bison, in spite of providing quantities of meat and other useful industrial materials, must have figured paramountly in noneconomic aspects of Caddoan cultures. But the dominating character of focal, East Texas Caddoan adaptation is local. Subsistence needs were met in a nearly total fashion by the natural environments of the area. Horticulture may have been one of the principal, if not the main, keys for maintaining this localized adaptive base, in face of what assuredly is a growing, endemic population and increasing demands on the area's fixed resource capacity.

Caddoan adaptive strategies under a focal, horticultural economy were no doubt quite variable as they became integrated with locality-specific biocenoses and endemic ecosystems. Because new considerations became important to the success of horticulturally based adaptations and because satisfying these new requirements demanded careful and precise choices of land tenure and use, the natural geographic distribution of spots where horticulture could be practiced came to be highly influential on population dispersion and settlement systems. Determinism, in this cultural (not simply environmental) sense, may have been far more extreme than in cases of diffuse adaptations.

The environment of East Texas is not homogeneous. It is exceeding heterogenous, and locales bearing all or most of the qualities essential to horticulture and other human necessities are not uniformly distributed. In fact, finding locales where horticulture can be practiced (given Caddoan farming technology) and where all other daily human needs can be satisfied (i.e., the empirical approach to defining catchment areas) is an extremely difficult task. This prospect is rendered even more difficult than the heterogeneity of the East Texas countryside suggests, because there are absolutely no data, archeological or ethnohistorical, on the relative importance of domestic vis-a-vis wild foods in Caddoan subsistence. Locales which have some horticultural potential might still have been occupied by horticulturists, pursuing one kind of economic strategy, while locales of higher potential productivity might have been occupied by other farmers following a very different strategy. There are many ways to do horticulture and it can be done in variable amounts, but if it is done at all, as it was among the late prehistoric and historic Caddo Indians of East Texas, there will be certain commonalities of adaptation (cf. Cleland 1976), which are amenable to conceptual modeling and archeological testing.

Empirical data on Caddoan settlement patterns has, like earlier periods, that nucleated, "reservoir, pool level" cast. Woodall (1969b) recognized the possible biasing effects of the "reservoir syndrome" on his reconstruction of the socio-political dimensions of Caddoan confederacies. Survey unevenness, even within the confines of reservoirs and other water project areas, is almost certainly another source of unascertainable bias on present pictures of site distributions (cf. Gibson 1978:20). In spite of these known biases, Caddoan settlement can be discussed in general terms, as long as it is recognized that it might not bear the scrutiny of particular places at precise temporal spans. As in the case of adaptive strategies themselves, it should be emphasized that there need be no necessary uniformity in settlement patterns across the Caddoan area nor through time, nor for that manner across time and space within even small regions.

In general, Caddoan settlement patterns seem to adhere to two major forms, nucleated and dispersed. The nucleated type consists of a large dominant town, or village, surrounded by smaller villages and/or hamlets. Centrality functions would appear heirarchical, that is, the importance of place and its influence on hinterland would be a direct function of its size and number of inhabitants. Small villages and hamlets under the nuclear model would have probably been economically self-sustaining, or nearly so, as would the central nucleus, but the economic sphere embraced by the entireity of contemporary settlements should be construed as the community catchment area because of reciprocal "economic" functions linking hamlets to villages, villages to villages, and all settlement nodes to the central town. Even if raw and unadulterated economic redistribution was missing or resulted in very small materialistic gain for the surrounding populace, the central functions of the large towns in noneconomic areas of cultural interaction, e.g., religion, ceremony

and ritual, seats of government, source of community leaders, rallying-points, public construction activities, or simply as a constant physical manifestation of the offensive and defensive spirit (or capabilities) of a group of folks, united through kith or kin or some other commonality, etc., are sufficient reasons to accord heirarchical dominance to the central town and lower orders of importance to the other villages and hamlets within the catchment. Such a perspective should help overcome recent empirical (Earle 1977) and archeological (Pebbles and Kus 1977; Steponaitis 1977) objections to the singular role of economic redistribution in creating and maintaining advanced forms of tribal organizations known as chiefdoms and restore confidence in systems of community interaction and in central place functions of large towns with their hinterlands, at least so far as archeologists are capable of detecting them.

Woodall (1969b, 1980) has posited just such a settlement model for the George C. Davis site, and similar forms can be expected around several other large Alto, Haley, and Belcher (Webb 1959) focus sites and catchments. In terms of relative site locations under the nuclear settlement model, one expects larger sites to be associated with larger patches of arable soils which occur in localities having the additional resources necessary for community maintenance; the smaller sites and hamlets might correlate with smaller, more dispersed plots of tillable soils and where a larger per capita exposure to edges (tension zones) would have helped alleviate the disasterous effects of that periodic crop failure or short-term shortfall in produced foods.

The other principal settlement strategy of East Texas Caddos was the dispersed type, perhaps best exemplified in the historical records of the Hasinai (Swanton 1942; Griffith 1954). The difference between the nucleated form, described above, and the dispersed type is a matter of degree as well as kind. According to historical accounts, the Hasinai lived in hamlets (called rancherios or cantons) scattered throughout the woods in small openings. According to Spanish informers (cf. Swanton 1942; Griffith 1954:49), the scattering of Hasinai cantons was due to the wooded, rolling nature of the countryside, where natural clearings were small and widely separated. The Caddo themselves, accounted from their choices of residence simply by saying that they "liked" open spots. Each family is said to have sought those spots located most advantageously with respect to drinking and bathing water and arable soils (Espinosa in Griffith 1954:59). The result was a community ". . . at least twenty leagues long; not that it was continually inhabited, but in hamlets of ten to twelve cabins, forming, as it were, cantons each with a different name" (Douay in Griffith 1954:59).

Yet despite physical dispersal of settlements across relatively large stretches of territory, there seems to have been an underlying nucleating principle, such as expressed by Bolton's (1908:270-271) statement to the effect that they (the Hasinai) lived in loose villages and scattered dwellings around their fields and that the scattered residences were grouped around central villages where the chiefs lived. Further support for central community functions, if not actual settlement correlates, may be anticipated in the person and role of

the Grand Xinesi, whom Griffith (1954:59), following historical narrations, describes as a "petty king over the Confederation" and as "a supreme chief" having both civil and religious authority over the nine Hasinai tribes. The Grand Xinesi was also the "high priest" of the allied tribes.

The pan-confederacy fire temple, administered by the Grand Xinesi was the ". . . center of Hasinai ceremonials and religious observances . . ." (Griffith 1954:70). Although the records are somewhat confusing on this point, the location of the principal fire temple may have shifted around (Griffith 1954:70), first at one spot among one tribe, then at another among a different tribe. If this interpretation is accurate, it may reflect the hereditary manner of succession to the office of Grand Xinesi. It may also simply represent confusion of the principal temple with secondary temples, serving more localized functions, which were located in the major villages throughout the confederacy; major villages being defined as the places where tribal chiefs (caddices) resided.

The systematic rounds and visits of the Grand Xinesi to the scattered villages of the nine or so confederated tribes also implies a degree of centrality, to ease (principle of least effort) this important means of demonstrating pan-confederacy authority and unity.

Woodall (1969b) believes that these central functions are vestiges of an earlier, more rigidly structured socio-political system, which was tailored around and administered through a more nucleated form of settlement.

To integrate the data on East Texas Caddoan resources and settlement into a predictive model of adaptation via a catchment approach, it is helpful to draw from some recent ideas involving resource procurement costs and procurement strategy mixes (Earle 1980; Christenson 1980). The Earle-Christenson approach is based on well-established principles in the field of economics and evolutionary ecology.

Underpinning the development of the Caddoan focal adaptive model is the assumption of population growth in East Texas. Swelling populations produced by the so-called "broad-spectrum", or diffuse, economies (Flannery 1969) of the Late Archaic-Pre-Caddoan stage faced the problem of diminishing returns, or more accurately, decreasing output (i.e., food procurement) for input (labor investment or initial and marginal labor costs). Christenson (1980:36) has generally addressed this problem in the following manner:

> At low densities a population will specialize upon a few low-cost resources. The food niche will be narrow and of low diversity, and the efficiency of labor in subsistence will be high. As population grows, the use of these first resources will be intensified and new higher-cost resources will be added. The food niche is now broader and more diverse, and the efficiency of labor in subsistence is lower. If it is possible, cultivation will usually be

> adopted at this point, and as population continues to grow, cultigens will begin to contribute more and more to the diet. Although the importance of wild resources in the diet will decline, they will not usually be dropped from the procurement mix until high population densities are reached, ... (emphasis provided).

What does this view and the principles on which it is based mean for the focal, horticultural adaptation of the East Texas Caddo? What deductions can be drawn from it that will permit empirical derivation of catchment areas and prediction of site locations within them? What implications does such a view have for the two, or possibly more, settlement strategies that seem to be correlated with Caddoan horticultural societies and for higher order reconstructions (e.g., Woodall's Alto chiefdom fragmentation and rise of regional Fulton confederacies)?

The addition of a cultigen or domesticated plant complex to the subsistence base of early Caddo may be viewed as a means of enhancing labor efficiency (input), grown less efficient because of population increases and resultant high transportation costs (i.e., expanding distances necessary to procure wild resources, especially mobile animals) (Earle 1980:5). The marginal costs associated with the intensification of a single resource, or resource complex (in this case, maize and possibly, but not certainly, beans), were evidently less than those involved in those longer distant procurement activities. As there is little evidence for settlement sedentism in Late Archaic-Pre-Caddoan times, such as is usually associated with concentrated, sessile, high yield, wild resources and fishing economies, the adoption of intensification of horticulture is thought to have brought to early East Texas Caddoan adaptive systems a relatively high degree of residential stability--settlement permanence. Cultigens have needs and requirements for growth, as do all living organisms, and propogation of these plants is also related to the level of horticultural technology. From an ecosystematic framework, the natural requirements and tolerances of domesticated plants and the technological means of propogation rendered certain places more desirable than others as sites for garden plots. Because selection of farmland became more important (relatively) than settlement choices predicated upon maximum ease of exposure to varied, wild resources (e.g., environmental edges), there should predictably be a high correlation of horticultural villages with plots of fertile, arable soils lacking tough and hard to eradicate vegetation cover and having elevations above annual flood levels. Just such a correlation is demonstrable for East Texas-West Louisiana Caddoan cultures (Woodall 1969b, 1980; Benham, Miller, and Sciscenti 1973; Gibson 1978).

However, soils of this nature are not the only consideration for village location. Because of the varied complex of foods, both domesticated and wild, known for Alto and Hasinai groups, the procurement strategy mix definitely shows integration with natural ecosystems other than those confined to plots of prime soils. Because of these additional factors, which will be identified presently, certain constraints would have been associated with each and every patch of tillable ground, constraints which might possibly have been more important in individual

choices of settlement locations than even the horticultural rating, or degree of fertility, of the soils themselves. From the viewpoint of settlement geometry, this means that distribution of sites might be as varied as the procurement strategy mixes were varied, even within soil zones amenable to horticulture. Actual numbers of people to be fed seems to be the most important variable in defining inhabitable locations. How they are fed--how much food comes from domestic as opposed to wild products--seems to be the primary determinant of individual village site selection. Since we know only that food mixes were basic to Caddoan subsistence, the following suggestions must be considered only as general aids in helping to circumscribe inhabitable areas, not as fail-safe predictors of physical site locations themselves.

The necessary sedentism that accompanies horticulture places a premium on locations that, not only support farming, but which lie near other resource zones that have special qualities. These nearby (nearby, measured in least effort terms, or in terms of energy expenditures as low cost) zones may be defined as those which maintain a rather constant energy subsidy or exhibit seasonal auxillary subsidies (cf. Odum 1971). In the "pineywoods" Caddoan area, floodplain biocenoses furnish such areas. In floodplains, aquatic resources, e.g., fish, shellfish, turtles, small mammals, etc., provide a relatively constant, little fluctuating natural energy source, a flow system constantly replenished by nutrient input into the running water system. In economic terms, aquatic resources are always there and are undiminishable by human exploitation activities. This capacity for energy flow maintenance is enhanced (subsidized) during the fall and winter months by the arrival and return of migratory waterfowl. Scheduled economic use of lotic (running water) ecosystems was closely tied to not only the natural periods of peak auxillary subsidies but to the particularized qualities of food animal and plant availability and accessibility. But the important, settlement-deterministic quality of lotic ecosystems is that they furnish a constant potential food supply that is augmented seasonally and which, because of its energy subsidies, cannot be significantly (for long periods) diminished by human exploitation.

Thus the incorporation of a segment of a floodplain (which includes the variety econiches utilized by the mammals, birds, fishes, and reptiles exploitated) within the catchment area of individual horticultural villages would have been as important to the Caddo as finding arable plots of land. Side by side, floodplain resources and tillable ground would have provided for year round foods in a relatively uniform manner. Shortfalls due to occasional crop failures or natural disasters (e.g., floods, droughts, etc.) may have periodically affected food supplies, but such effects would have only been more amplified in catchments that lacked large segments of floodplains. The capacity for rapid rejunvenation of lotic ecosystems may have been an important factor in village survival and community maintenance following such disruptive events. From this line of reasoning, so important would have been the floodplain biocenoses to Caddoan subsistence that some degree of laxity could have been

allowed in choosing farmlands. In other words, a large plot of highly productive soil that lacked convenient exposure to floodplain ecosystems might have been passed over in favor of smaller, or more marginally productive, spots that lay near these lotic biocenoses.

Of course, how much lowland territory needed to have been included in Caddoan catchment zones would have been, as mentioned above, a direct consequence of the numbers of people to be fed. It was related, additionally, to the procurement mixes of individual groups, but the amount of floodplain and the percentage of mix are dependent variables. However, independent and dependent variables aside, it may be said that East Texas Caddoan folks, like subsistence farmers everywhere, fully realized the inevitability of that periodic lean year and planned their long-term economic strategy to overcome its effects. This can be done in many ways, the development of efficient means of storage comes immediately to mind, but an alternative--one that does not necessarily have to do with technological innovations or increasing efficiency--would have simply been to incorporate large tracts of floodplain biocenoses within village catchments. To put this in the form of the decision options open to Caddoan horticulturists, the deterministic input for village founding would have been based partly on the potentiality of a parcel of good soil for horticultural production and partly on the location of that parcel with respect to lotic resources; immediate and short-term productivity being given some weight and, based on the recorded reluctance of the historic Hasinai to shift locations (cf. Woodall 1980:147-148), an equal weight evidently placed on considerations of long-term productivity.

The Spanish chroniclers explained the Hasinai reasons for not wanting to move to new locations in a different fashion, as might be expected. Thus Cananas (in Hatcher 1927:28) related, "I believe it would be very easy to induce them the Hasinai to live close together. What they will dislike most will be to build new houses and to open new ground for planting." In Espinosa's words (in Hatcher 1927:153), ". . . since the country is so thickly wooded, there are no places suitable for irrigation even with a great deal of work. This has been the greatest difficulty at all times in gathering the Indians into compact settlements."

The etic view of the Spanish narratives probably based on emic explanations of the Hasinai themselves is no doubt rooted in the strictures to settlement outlined above. Building houses seems to have been little trouble (cf. Griffith 1954:99-100), their construction was a communal endeavor generally taking only half a day. Clearing and planting new fields may have not been particularly joyous occasions, hence producing the Hasinai's explanation for not wanting to move to new areas to facilitate Spanish missionizing efforts, but the fact remains that the Caddo did clear and plant--their existence depended on these activities. Thus the Spanish explanations of the Hasinai excuses for preferring to remain at their villages miss the underlying economic implications that really furnished the basis for this reaction. The Indians understood, but the explanations given the Spanish were couched in the only terms the missionaries could understand--too much hard work.

Familiar, self-replenishing catchments are not easily given up for the uncertainties of new territories. Village economic autonimity will not be compromized by population nucleation in areas where costs of procurement input approach or exceed output, unless populations can be subsidized by outside resources which involve no or minimal costs to the native procurement strategy.

Woodall (1969b, 1980) has modeled the soil-settlement relationships in the Caddoan area in order to explain the shift from Alto chiefdoms to Fulton confederacies. In his suggested correlations, he emphasizes not only the potential productivity of various soil types but their sizes and dispersion. His findings are germane to the present consideration, not necessarily because of their relevance to the chiefdom disintegration-confederation emergence hypothesis, but because they aid in extracting broad, regional patterns of settlement. He found a clear association between large tracts of productive, arable soils and large Caddoan villages, as well as a small village hamlet-small plot correlation (Woodall 1969b, 1980). Woodall even anticipated the present, more detailed catchment model by attempting to explain why some apparently large zones of favorable horticultural lands were not occupied by the Caddo. The present model of Caddoan catchment areas simply refines Woodall's environmental but nonecological approach.

Euro-American Adaptive Developments

The arrival of Euro-Americans in East Texas did not result in a truncation of the adaptive patterns already in existence. The pattern of mixed economic strategies which formed the basis of Caddoan existence were replaced, to be certain, by Anglo strategies, but the "replacement" simply involved the substitution of one mixed economic strategy for another. The procurement strategies themselves were not that radically different. Subsistence farmers, who occupy a common territory, even in a temporally sequent fashion, share, regardless of national or ethnic origins, a large measure of commonality. Differences will exist, to be sure, but they relate to technology, labor source, and procurement mix factors, not to completely different adaptive systems.

Caddo removal by the 1830 -1840s, the expansion of transportation networks (waterways, the Red and Sabine rivers, and overland roads, the El Camino Real--from Natchitoches to Nacogdoches), and the settling of territorial disputes first between colonial powers and later between Mexico and the United States, opened East Texas, including the Upper Sabine Valley, to Euro-American pioneers. The movement of Anglos into East Texas can be viewed as a consequence of two principal factors, which might be considered as a push-pull force. The push was provided by the expanding plantation economy throughout the lowland South. The ever increasing need for larger and larger sections of arable land for cotton production--the principal money

crop--forced the poorer, subsistence farmer into marginally productive areas (i.e., the "pineywoods hills"). The pull of East Texas was the availability of vast areas of unoccupied or sparsely occupied land, which could be homesteaded free or purchased cheaply.

Unable to compete financially in a cotton-cash dominated market system and being "shoved" ever downward in the rigid social hierarchy which resulted from the plantation economy, some Anglo settlers simply retrenched into an old-fashioned but tried and proven adaptive strategy, one that guaranteed self-sufficiency and familial or small community economic autonomity--small scale subsistence farming and animal husbandry. Tenure in the Upland South, prior to migration into East Texas, molded technology and economic strategies into a consistent pattern which, like all successful means of adaptation, rendered procurement input costs compatible with output. The result of this "pineywoods hills" procurement mix was an adaptive system quite similar to the Caddoan pattern achieved much earlier.

The picture of Anglo expansion developed here stands in contrast to the frontier model outlined by Turner (1920), a model that emphasizes the influential role played by the frontier edge itself in producing a serial pattern of economic changes which, in order, included hunting, trading, herding, extensive farming, intensive farming, manufacturing, and finally urbanism. The arrival of Anglo-Saxon folks in East Texas from the east (Louisiana and Mississippi) required no basic changes in economic strategies. The "pineywoods hills" of East Texas were very similar to the "pineywoods hills" throughout the eastern sections of the Upland South, from whence the East Texans had migrated. The economic patterns which had been developed there worked equally well in East Texas. The entire adaptive system was simply "imported in toto" and structured into the geographic layout of the East Texas countryside. It did not develop in East Texas, nor did it have to be modified upon arrival.

Newton (1974:147) considers the pattern of the Upland South, Anglo-Saxon "peasant" to have been "preadapted" to the many areas it entered during the general western expansion; preadaptation, in this context, referring to the competitive advantages if offered. Some of the principal salient features of the Upland South "peasant" system are identified below (adapted largely from Newton 1974).

The settlement pattern was of the dispersed type, which allowed relatively small numbers of people to claim (and use) large tracts of land. Residential areas comprised small hamlets and/or scattered dwellings (individual farms). Kinship ties were integral to the physical layout of farms and the system of land inheritance served to reify these ties and to account for a certain degree of the agglomeration in hamlets. Kith and kin relationships were also important in defining community boundaries, and, much like the Hasinai pattern which had preceded it in East Texas, individual communities came to be recognized by different names. Dispersed throughout these communities, or "neighborhoods", were a variety of rallying points--churchs, cemeteries,

schools, mills, feed and farm equipment supply houses, blacksmith shops, etc. (Mitchell 1967), which provided both economic and social central place functions.

Adaptation, though characterized as focal (cf. Cleland 1977), exhibited a quite flexible procurement strategy mix (cf. Earle 1980). Agriculture, horticulture, animal husbandry, hunting, fishing, and wild food collection were integral to the economy (Webb 1979:1-20), but the importance of each to family and community maintenance was variable. Webb (1979:1-20) has described one such strategy mix on a larger than usual farm in the old Caddo territory along the Red River. This flexible arrangement is perhaps the single most prominent aspect of the Upland South "peasant" adaptive system, one which allowed its success throughout the many regions into which it spread.

Agriculture, given to commercial cash crops, usually centered on the production of cotton and/or corn but was capable of practically unlimited expansion to any crop (e.g., strawberries, indigo, sweet sugar cane, etc.) which commanded, at the time, high market value. The same may be said of animal husbandry. The proportion of strategy mix provided by this activity came and went as easily as marketing emphases. High initial energy costs expended in the market production of cattle, hogs, horses, mules, etc. resulted in intensification of agriculture and a downplay of horticulture. However, actual human labor costs associated with agricultural intensification were alleviated somewhat by the use of draft animal energy, and later by technology in the form of water, steam, and gasoline-powered machines. The ultimate effect, nonetheless, was a long-run, overall reduction in efficiency. The disproportionate direct loss of foods from horticultural production caused by the intensification of marketable resources was offset by the increased buying power which resulted. And the system itself derived a means for minimizing marginal costs; a means which provides one of the distinguishing hallmarks of the Upland South "peasant" adaptation. The dispersed settlement pattern with its large, unoccupied, intervening tracts of land was simply used as free-range for domestic animals. Cattle and hogs were permitted to run loose in the "pineywoods" and hardwood bottoms, foraging on the land and not requiring feeding by farm-produced grains and grain by-products. Roundups of these feral animals was seasonal and usually involved groups of kinfolks. At these times, animals were marked (either branded or ears were cut with the "owner's" mark), cut (casterated), and were "kept up" for fattening if designed for marketing. If the animals were for home use only, a few select ones were penned, the remainder released. After a few weeks of being corn and "slop" fed, these animals were killed and butchered in a communal get-together involving family and close friends. These "hog- and cow-butcherings" served a redistributive economic function in the days before refrigeration, as well as an important social integrative function.

Household foods from the gardens (i.e., horticulture) consisted mainly of corn, beans, peas, squash, Irish potatoes, sweet potatoes, pumpkins, cabbage, tomatoes, okra, cucumbers, collard and turnip

greens, and others. These were used fresh or were stored by "canning". Some corn was ground in small "grist" mills run by waterpower. Sweet sugar cane was usually grown by a few farmers and rendered in small, mule- or horse-drawn "grists" into that thick delicacy, cane syrup, that no respectable country table could be without. The fame of some syrup-makers was legendary, and folks came from far and wide to buy or trade for Mr. "So-'n-so's" syrup.

Fishing, hunting, and wild plant collecting added important seasonal foods, although the strategy mixes involving these activities was quite variable. Dewberries, blackberries, wild plums, 'possum grapes, muscadines, persimmons, mayhaws, crabapples, elderberries (Webb 1979:16) were gathered in season and eaten raw, in a variety of pies or "cobblers", or converted into jellies and preserves. Hickory nuts, black walnuts, pecans, and chinquapins (chestnuts) were collected in the fall and saved for Christmas cakes, cookies, and candies, or stored for year-round "treats". Sweet gum sap was used for chewing gum. Wild beehives were robbed for honey. Small migratory birds, especially robins, blackbirds, doves, among others, added occasionally to country tablefare and furnished an important source of peer group prestige among the little boys who hunted them. More serious hunting by men and boys alike centered on seasonal waterfowl and a variety of upland game. Rabbits, squirrels, and especially deer provided supplemental fall and winter meats. Deer hunting, in fact, provided an important community integrative function. Deer were hunted by groups of families and friends in a peculiar fashion (Kniffen 1944). Areas were surrounded by "standers" placed at strategic points ("crossings", "runs", "rubs", etc.) by the hunt leader ("driver") and dogs, including a variety of deer hounds (Walkers, Black and Tans, Beagles, and sometimes, "curs"--Catahoula Hogdogs) were used to "jump" and drive the deer by the stationary "standers". Venison was divided among all the hunters, with the largest or most preferred cuts going to the dog-owner and/or hunt leader who often was the same person. As in the case of domestic animal free-ranges, deer were generally hunted throughout the woods intervening between farms and small communities without use restrictions by individual landowners. Permission to hunt on someone's land was never requested nor were such requests expected by landowners. However, certain territories came to be respected by everyone as one person's or another's hunting grounds. Hunt leaders acquired certain statuses which, though largely temporary in nature, quite often carried over into and influenced social relationships during the remainder of the year.

Resources, other than foods, were derived largely from the catchments surrounding individual farms. Again, procurement of local resources was somewhat variable depending on the amount of money, surplus trade commodities, or special skills and services available and sought with community exchange systems. Early on most of the buildings and other structures made, often through communal help (i.e., a house or barn-raising), of locally abundant materials, such as wood, rocks, and clay. House construction was first of the modular, pen and crib type (Kniffen 1965; Newton 1971). Single- and double-pen and large and small "dog-trot" houses, the latter often enclosed by

"galleries" on three or four sides, were architecturally dominant. Log construction gave way to lumber with the rapid expansion of the southern lumber industry. Small, one-man sawmills were generally replaced by large mills, which in the days preceding reforestation, simply came into an area, clear-cut the timber, and pulled out with the exhaustion of the trees. Mud, or stone if available, was used to make chimneys and in some cases, local sandstones and mudstones furnished house and fence building materials. Locally made bricks, however, soon took the place of these resources. Webb (1979:19) indicates that certain, nonfood wild resources, such as special kinds of desirable woods, might be gathered from far outside the normal catchment area surrounding the farms, thus producing temporary extensions of exploitation zones.

Additional characteristics of the Upland South "peasant" adaptive system appear in nontechnological, noneconomic levels of culture, though, as is clearly recognized, meaningful separation from things purely economic is not possible (cf. White 1949, 1959), except for heuristic purposes such as this. Religion was a foundational element of this adaptive system. Denominations included Baptist, Methodist, Presbyterian, Penecost, and other smaller sect-like groups, but no matter what "church a person belonged to", there was a single underlying commonality--roots in evangelistic, atomistic protestantism and its world--shaping precepts and values centering on individualized hard work. Protestant ethics (Weber 1958; Peacock 1975:82-92) underpinned southern upland communities everywhere and were so thoroughly integrated with economy that at least one participant-observor has questioned the widespread interpretive usefulness of the principle of least effort in characterizing these contexts (Webb 1979:19).

The protestant ethic also provided social sanctions and "unwritten" community "laws". The individualism of the hard-working protestants gave them strong antifederalistic sentiments which even further reified this individualism, independence, and self-autonomity (cf. Whitaker 1962:91). The predominant source of governmental authority in Upland South communities reflected this antifederalism; small political units, i.e., counties, exercised authority through a county courthouse judicial and county-wide governmental structure. Enforcement of laws was vested in county sheriffs, but a strong individual sense of "law and order" and "right and wrong" reduced the need for frequent demonstrations of enforcement capabilities. However when force was required it was usually strong and unyielding and greeted with general acceptance by the community.

The growth of towns in Upland South regions concentrated nonfarm specialists (e.g., doctors, lawyers, and other skilled elites) and brought a much wider variety of farm-orientated services, equipment, and commodities, as well as "luxury" goods and services. An incipient social stratification emerged. Social prestige accrued to the technically skilled elitists, e.g., doctors, dentists, lawyers, etc., who produced no real consumable products but provided services considered essential to community well-being. Older, prominent

landowners, public servants, and the like, though possibly less wealthy than the technical elitists retained high social status. Merchants and other service operators tended to form a middle class, while laborers and the typical small farmers constituted the lower class. Negroes and other minorities, if present, lay outside this structure. Though stratified with clearly defined class parameters that were easily recognizable by all members of the community, the social class structure of Upland South communities was an open one. For example, intermarriages between classes might not have been preferred but they were generally not prevented. Central community functions were participated in by all levels of the hierarchy regardless of rank. Churchs, schools, and town meetings served to cancel out the potentially disruptive effects of social stratification. But the openness of the structural arrangement is nowhere more evident than in capabilities for upward mobility available through a variety of economic, professional, political, and social channels (Owsley 1949). Motivation for such mobility was directly related to the strong protestant ethical background, and though overt family pressures were usually minimal, children grew up under constant, usually unspoken, expectations to achieve higher standards than had their parents.

The continuing operation of the Upland South "peasant" adaptive system has resulted in the production of hard working, highly motivated, achievement-orientated individuals. It should come as no surprise that economic changes and trends in East Texas during the twentieth century have in large measure been set in motion and perpetuated by this ethos.

Although focal in nature at the time of implantation in East Texas, the Upland South pattern was quite flexible in terms of procurement strategy mixes. Economic catchment areas were generally small but associated rights of usufruct served to extend certain catchments involving domestic and wild animal resources and construction materials.

Continuing population expansion in the region, a consequence of both emigration and natural growth factors, set in motion certain changes in the adaptive system. In response to increasing numbers of folks (i.e., population as the independent variable, cf. Boserup 1965; Earle 1980), there developed an exceedingly complex and intricate arrangement of energy flow, occupational structures (labor differentiation), and procurement strategy mixes. Into this complex fed the achievement values and individualism of the protestant ethic. One noticeable relationship among these factors is that as opportunities for success expend with occupational differentiation, communities will grow and in turn create even more opportunities. This tends to keep the "natives" at home. Yet when such opportunities do not keep pace with population growth and when occupations become overwhelmingly energy inefficient (as is expected under the law of diminishing returns, cf. Earle 1980:10-11), then two things usually happen. Holders of energy inefficient jobs will move away if strongly motivated by achievement principles; holders of more efficient jobs, e.g., small farmers and farm servicemen, will remain. Thus as outside emigration brings local development to a maximum, under any particular pattern of adaptation, there will be consistent growth. Urban trends will occur. Increasingly

large numbers of people will be divorced from direct food and other resource procurement activities. More and more reliance will be placed on the nonproducers' means of acquiring necessary resources--money. When input (in terms of energy) begins to approach output, or in other words, when profits are reduced below an acceptable level (cf. Earle 1980:8, 14), as will happen when initial energy expenditures rise because of increasing technological, transportation, collection, processing, and/or storage costs (Earle 1980:5-6), the means of acquiring money will usually be withdrawn and extraregional migration will occur.

Thus economy does set strong limitations on regional growth patterns. East Texas provides an excellent case study in this regard. Fluctuations in cash economy resources have transpired in East Texas, and the general adaptive syndrome described above has accompanied each.

By the 1850s, even relatively small East Texas farms depended on a single cash resource, cotton, as a source of acquiring nonfarm-produced commodities and services (Campbell 1974). The intensification of cotton production resulted in much higher initial labor costs, even though draft animals, slaves (Campbell 1974:63), and machinery were used. Such intensification became inefficient as constraints to expansion surfaced because of patterns of land tenure and ownership, the dissected terrain itself, and the freeing of the "cheap" source of labor, slaves. Even technological advances could not alleviate the growing inefficiency because the "pineywoods hills" of East Texas were simply not amenable to extensive agriculture (cotton farming) even with tractors and other human labor-saving machinery. When output from cotton farming reached an unacceptable profit level, it was generally dropped, and economy retrenched into familiar subsistence patterns.

In the 1890s, lumbering became an important aspect of regional economy (Maxwell 1971). It too was fleeting because of the practice of "clear-cutting". When all the locally available timber was cut, and procurement costs, especially those associated with transportation, rose to levels that compromized profits, the lumber (and associated navel stores) industry simply moved out (by the 1930s) taking with it people, jobs, and other associated dimensions of economy. Some adaptable services and the occupational opportunities they offered remained, but, by and large, a regional "vacantness" followed. Nonaffected small farmers continued, but even their effectiveness was hampered (i.e., procurement strategy mixes changed) because of landscape denudation and resultant widespread erosion. In other words, the Upland South "peasant" adaptive pattern continued, but the numbers of people it could support, or who were willing to retrench, diminished.

With the declining timber industry came another focal activity that drastically affected East Texas economy. The discovery of oil and gas and the springing up of nonsubsistence petroleum industries again resulted in population emigration into the region and led to further occupational differentiation with their associated

opportunities for financial gain and social elevation. As the need for petroleum products grew to epidemic proportions, literally fueling the entire economy of a nation and nations, a large gap ensued between food producers and nonfood producers associated with the petroleum industry and its many attendant service industries. For the first time, a large segment of the population became divorced of the need for direct access to land. Feeding large numbers of people not directly involved in food production not only led to heavy demands on local economies but contributed to much higher costs of food production. Intensification of production resulted in such high input expenditures that the only way to maintain an acceptible output (profit margin) was to expand farming operations. Large mechanized farms replaced the small subsistence farm in those areas where agricultural land was most extensive. The small farmer became obliged to shift activities to supplemental, support industries (e.g., dairies, etc.) or to abandon farming entirely. Those who shifted to support capacities were soon faced with the same burgeoning initial cost outlays that underpinned extensive farming operations as demand exceeded supply. However, the universal unit of exchange, money, of which there was now a large, but unevenly distributed, supply, enabled East Texas residents to broaden their economic catchment area. Railroads and highways made for acceptibly "cheap" transportation and collection costs. The result was the incorporation of widely separated sources of essential resources into a unitary economic sphere. East Texas economic catchments extended from Dallas to Shreveport to Oklahoma City and even beyond.

This economic trend was not, however, capable of limitless expansion. Rising costs within the oil and gas industry itself, incurred as production dropped and more distant sources had to be exploited, produced rising costs in all the support areas, including food production and acquisition. The result was the partial abandonment of oil and gas fields which had reached a low level profit condition. Big companies pulled out. Small "poor-boy" outfits, to which lower profits were acceptible because of smaller overheads, took over. Population emigration again ensued. Left was the hard core nucleus for whom the Upland South adaptive pattern and protestant ethic value system still furnished an acknowledged way of life. Economic retrenchment again occurred but by this time the differences between the upper and lower financial echelons were extreme indeed. The poor had gotten poorer; the rich, richer. The small subsistence farmer who had been crowded out by the more inefficient larger farmer had lost access to the land or had been relegated to its poorest corners. Those who were landless either moved or went to work for the larger agricultural co-ops, whose strategy mixes fluctuated from truck farming to ranching depending on profit margins, which themselves shifted with the almost whimsical market picture.

The entire process is being repeated with the now profitable reopening of "depleted" oil and gas fields and the return of lumber companies based on reforestation management. New technology, especially automation, and high profit margins associated with the inflated prices of petroleum and timber products, are once again bringing change to the economic catchment and adaptive pattern of East Texas peoples.

There is little doubt that these changes will again be cyclical, and there is even less doubt that the thread of continuity that will link pre- and post-petroleum eras will be the flexible Upland South adaptive system.

SUMMARY

The sequence of adaptive changes in the "pineywoods hills" of East Texas over the last 12 millennia, summarized in the preceding pages, is essentially in order. The economic data, derived from archeology, ethnohistory, history, and participant-observation, have been presented as they were available or reconstructible. They have furnished the empirical stuff out of which the East Texas adaptive systems have been reconstructed and out of which the detailed, testable models, presented in Chapter 4, have been developed. Their subsumation under the site catchment-economic energy flow approach, followed herein, may not go unchallenged, and arguments over the applicability of certain models will almost certainly result. Yet the present approach represents a new slant on East Texas adaptations, an approach considered worthwhile because of its potential to predict (not merely project) site locations and to empirically test, not merely reaffirm or identify, empirically derived models. The Big Sandy project is an experiment. If we learn anything from it, it will have been a successful exercise.

CHAPTER 3

THEORETICAL AND METHODOLOGICAL BASES

INTRODUCTION

The Big Sandy reconnaissance had two primary objectives: a) to satisfy agency requirements under various federal laws and b) to enhance cultural understanding of the Big Sandy Creek floodplain. In this author's opinion, these objectives are really inseparable. They are two sides of the same coin. By increasing understanding of the cultural resources in any given locality, we increase our ability to make judgments of significance, to predict site locations in unsurveyed tracts, and to make recommendations for the long-range conservation management of such resources; all of the latter falling within the agency's charge under legislated regulations.

In order to realize these objectives, it is necessary to plan a research program that not only goes directly to the heart of these issues but which clearly sets forth its theoretical bases, its methods, its organizational structure, and its procedural dimensions. This necessity holds for even small projects, such as the Big Sandy reconnaissance. As a matter of fact, reconnaissance level projects, where only a small portion (sample) of a study area is physically investigated, must be especially careful in spelling out and justifying their research bases because they have the additional statistical problem of the relationship of sample to universe.

STRUCTURAL ORGANIZATION OF THE PROJECT AND THE PROCESS OF INVESTIGATION

The structure of the Big Sandy project may be divided into several hierarchical levels with each level feeding into every other level. It may be compared with a flow chart in which the severalty of mutual feedback levels furnishes the project organization. The order of levels is critical, for each builds on the other. The hierarchical framework of the Big Sandy investigation also serves to distinguish it from other reconnaissances which follow an approach in which data are collected in a theoretical vacuum via largely mechanical means without any appreciation of regional problems and no ideas about what to do with the data once amassed. Six levels furnish the structural organization of the investigation; these include: theory, research design, research strategy, data acquisition,

data analysis, and data evaluation, interpretation, and reformulation. The flow of information through this framework constitutes the process of investigation. Since the project organization is a means of guiding and directing information through a series of steps and decisions, it is amenable to illustration by flow charts. The several levels of project organization are discussed below and, where appropriate, are accompanied by flow diagrams. Only the mechanics of the investigative process are set forth here. Relevant information and derived models will be presented in Chapter 4.

Theoretical Foundation

Theory may be defined as a set of assumed relationships that can be used to explain, predict, and provide understanding (Kinloch 1977; Binford 1977). The present project will attempt "to explain, predict, and provide understanding" of the spatial distribution of prehistoric and historic sites in the Big Sandy Creek drainage of East Texas. The theoretical underpinnings and theoretical process involved in this effort are diagrammed visually in Figure 3.1.

The starting point for theoretical application rests in the assumed relationships between population and cultural adaptation, especially as expressed by population increases and changes in adaptive strategies (Figure 3.1a). Models of these relationships, particularly those developed by Boserup (1965), Earle (1980), and Christenson (1980), will be employed in this consideration. Although these models recognize the exceedingly complex, deterministic and feedback relationships between population and cultural components, they share one commonality--population is viewed as the independent variable.

The theoretical approach followed here is operationally diagrammed in Figure 3.1. The assumed relationships it expresses are simple. Population numbers condition procurement strategy. Procurement strategy defines (and refines) necessary resources. The distribution of high yield resources and the principle of least effort produces a spatial pattern of human activities, which in turn results in physical manifestations, i.e., sites, over a landscape. The relationships among these concepts, once operationalized (cf. Figure 3.2), should permit the locations and kinds of sites to be predicted; thereby providing a set of expectations (i.e., hypotheses) amenable to empirical testing and confirmation-disconfirmation.

It should be emphasized that population numbers, under this theoretical approach, are said to only influence procurement strategy--that economic subsystem dealing with the acquisition and processing of foods and other essential resources (Flannery 1968). Population does not determine forms of adaptation *per se*, nor enabling technologies, but it does establish the parameters on which any adaptive form is predicated and by which it is modified. The relationships between population and economy, posited by Earle (1980) and Christenson (1980),

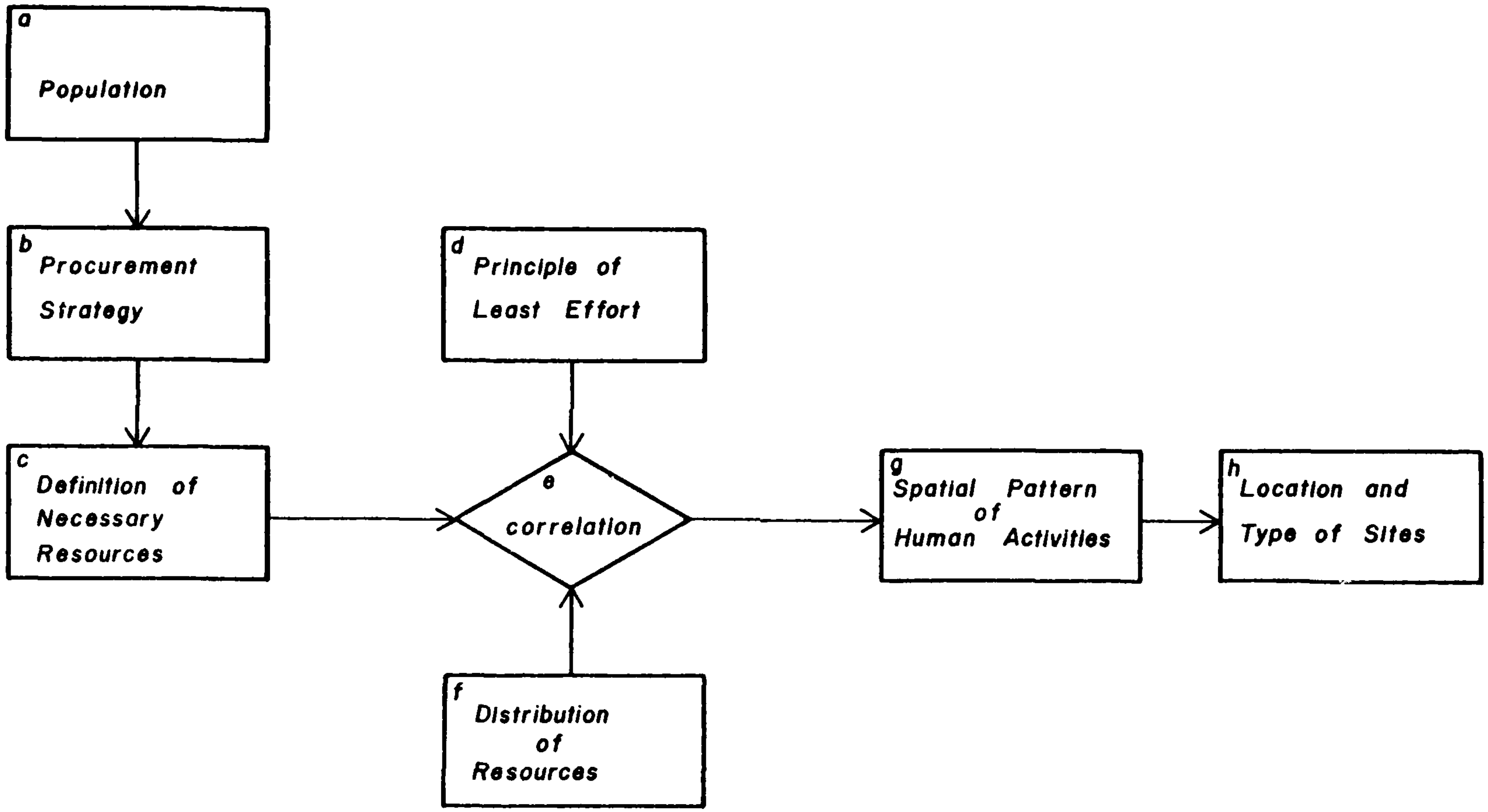

Figure 3.1 Diagram of Theoretical Approach

provide the working hypotheses for the present undertaking. A simplified version of this operational model is presented. As population grows in any locality among resident groups sharing a common technology and similar adaptive pattern (i.e., horticultural or nonhorticultural), certain changes will occur in procurement strategy because of the law of diminishing returns. Providing that resources do not change because of climatic shifts or ecosystem disruption within a given catchment area (i.e., exploitation territory), the increasing demands on local resources will produce higher costs and greater inefficiency in the input to output ratio (Earle 1980; Christenson 1980). Higher costs are associated with the larger amounts of cultural energy (e.g., labor) which must be expended on technological production, on transportation to and from resource areas, and on collecting, processing, and storage of resources (Earle 1980:5-6). When the input to output ratio is expressed in terms of calories, the implications for local group subsistence become revealing indeed. The effects of this process on procurement strategies are significant. As immediate resources became diminished in relation to demand, more distant sources would have had to been exploitated and/or new resources would have been identified and procurement strategies developed or modified to accommodate them. In the former case, if "open" territories were available to local groups, they may have chosen to move locations and maintain a relatively unchanged procurement strategy. Groups that remained within familiar catchments changed procurement strategies to minimize input (initial costs) and maximize output (resource production). The minimax principle could have been operationalized by exploiting new resources or intensifying exploitation of a single or smaller range of high yield, "renewable" resources or by concentrating on the production of new, introduced resources (e.g., tropical cultigens).

Wild resources, in the case of exploitation, and cultigens, in the case of production, both have spatial dimensions. Wild resources are <u>distributed</u> over the landscape as natural ecosystemic requirements and limitations are distributed. Domestic plants, on the other hand, are <u>distributable</u> by the same constraints but also are affected by heavy doses of technology.

These distributional aspects of food and other essential resources will determine the dispersion, density, and pattern of procurement activities. Thus human activities, as they reflect procurement strategies, also assume a spatial dimension. The distribution of the objectifications of these activities, i.e., sites, can be viewed as representing the means by which local populations arranged themselves over the catchment landscape in order to minimize effort and maximize resource return.

Hence sites become the empirical representations of adaptive systems. Sites are not uniform in nature nor ubiquitous in distribution. Both nature and distribution of sites are controlled by the relationships of the variables identified above. The variable activities, expressed by the character and context of residual material cultural assemblages, should inform on the procurement strategies followed. Finding and studying sites should permit evaluation of the parameters

and predictions of the various models constructed in theory. How and of what matters these conceptual models are to be constructed are the topics dealt with under the section on research design.

Research Design

The concept of catchment area (cf. Vita-Finzi and Higgs 1970) provides a methodological vehicle for operationalizing the theoretical approach and thereby a means for anticipating location and type of site. A catchment may be defined as the area surrounding a site from which the contents of a site were obtained (cf. Higgs 1975:ix, in Roper 1979:124). Being able to identify the various resources used by residents of a site and their relative importance, as well as the technology of procurement, enables the researcher to define a catchment area. The usual technique for approximating site catchments is to draw concentric lines around a site, either circles of fixed radii or contours connecting points of equal walking distance time (e.g., one hour, two hours, etc.) (Roper 1979:122-123). By ascertaining the occurrence and kinds of utilized resources within these approximated catchments, comparisons can then be made with site-specific resource uses to determine their relationships. Comparative results may then be used for a variety of ends, such as evaluations of cultural historical problems and of economic, settlement, and demographic models (Roper 1979:135).

Thus the usual approach to site catchment analysis depends on a knowledge of site location and site content. Under the theoretical model assumed here (Figure 3.1), *a priori* knowledge of site locations and resource content is not necessary. The relationships among the theoretical concepts (Figure 3.1) hold regardless of which conceptual area provides the initial, primary input. It should work as well in reverse as forward. Dickson (1980:697-712), for example, started with a site and its contents and derived population estimates for the Lowland Maya site of Tikal, Guatemala. This example carries through the entire series of relationships expressed in Figure 3.1. Other catchment analyses have stopped short of population reconstructions, usually in the conceptual area of procurement strategies (Figure 3.1b).

Since one of the goals of this investigation is to predict site locations and site types in unsurveyed portions of the Big Sandy drainage on the basis of small sampled tracts (totaling only 1280 acres, about 5.18km^2), we have chosen to approach the actual field reconnaissance in the fashion shown in Figure 3.1, as read from left to right. The aim is thus to predict site locations not to derive catchments and reconstruct economies from sites already known or to be found during reconnaissance field work. Thus in an operational sense, the present approach reverses the usual manner of site catchment analysis by attempting to first, empirically derive catchment areas (real catchments not merely site-specific exploitation territories, cf. Roper 1979:124, for distinctions between these concepts) and then

use them as the basis for determining the sampling strata and their on-the-ground location and thus for prediction of site locations and types. In this sense, the present effort cannot be called a catchment analysis per se, although it does represent a catchment approach.

According to Roper (1979:129-130), empirical approaches to defining site catchments (i.e., real catchments not territories) are extremely rare. She found only two examples, an hypothetical exercise by Foley (1977) and a data-based examination of catchments in Oaxaca and Tehuacan by Flannery (1976); the Flannery study was, however, tied to specific sites, although not to arbitrary approximations of catchment zones (i.e., circles of fixed radii or time contours).

The research design by which catchment zones are to be empirically selected is presented graphically in Figure 3.2. The concepts linked in this relational scheme do not necessarily represent the most revealing or "accurate" diagnostics of catchments and settlement correlates but rather a compromise among data availability, conceptual manageability, and predictive powers.

Both environmental and cultural data for the general area of East Texas are available (Chapter 2). Three categories of raw environmental data (Figure 3.2a-c) are relevant; these are defined conceptually as environmental qualities and "resources", the latter broken into two types, entropic and negentropic resources. Subsumed under the environmental qualities concept (Figure 3.2a) are culturally important, nonpermanent or nonphysical variables. These are myriad and include such things as rainfall, dewpoint, frost-free days, environmental edge, dirunal and seasonal shifts, as well as other considerations such as defensible position and siting aesthetics.

The concept of entropy underpins the division of physical "resources" into two categories (Figure 3.2b-c). Entropy refers to the property of systems energy states to become disorganized, dispersed, and uniform. Negentropy means the opposite. The concept is useful for present purposes when applied to the state of "resources" at the instant of exploitation, not to the changing conditions of individual "resources" throughout their entire cycles of existence. Rocks, for example, might be considered negentropic while forming, but after formation (when exploited by humans) they are entropic, that is they are breaking down through weathering and being reduced and carried away by streams. Rocks become pebbles; pebbles, sand; and sand, dust. Entropic resources, therefore, include mostly those nonorganic materials of potential usefulness to humans. Negentropic resources, on the other hand, are usually growing, living things, e.g., animals and plants, whose existence cycles, at least temporarily (during life) exhibit organization, concentration, or specialization.

Environmental qualities and resources (potential resources in this context) vary across the landscape. Where certain of these factors are found together and/or where they mutually interact as ecosystems, they produce biocenoses (Figure 3.2d). Biocenoses refer to the spatial dimension of an interacting web of plants and animals whose

needs bring them together in a common spatial locus, a locus independent of their geographic origins (Ozenda 1978:40). Biocenoses form, for purposes here, mappable units.

Biocenoses have qualitative and quantitative dimensions that furnish additional, essential conceptual input into the process of empirically delineating catchment areas. Productivity is one of these dimensions (Figure 3.2e). Productivity can be measured and quantified (Figure 3.2e). Productivity, as used here, refers to the economic potentiality of the aggregate of environmental qualities and resources (entropic and negentropic) within particular biocenoses. Productivity is not, however, uniform throughout biocenoses. It varies as environmental qualities and resources are spatially distributed. It also changes diurnally, seasonally, and over longer regular or irregular cycles. The distributional aspect of environmental qualities and resources, or the spatial/temporal structure, of biocenoses furnishes the other principal dimension of biocenoses that must be considered (Figure 3.2f).

The above described concepts (Figure 3.2a-f) provide the environmental input into catchment definition. However before the geographic aspect of economic productivity can be transferred to a map as an empirical catchment area, its "boundaries" and relevance to the economies of East Texas residents (aboriginal and nonaboriginal) must be established. This requires an independent line of input into catchment modeling (Figure 3.2g-i).

Two cultural variables provide basic information. First, the resources actually used by populations in East Texas must be identified (Figure 3.2g). There are two primary sources of resource use data, archeological and historical. Archeological data derive from site-specific situations where food and industrial materials have been recovered and identified. Historical data comes from recorded observations. In East Texas, such records began with the DeSoto-Moscoso expedition in 1542 (cf. Bourne 1904; Varner and Varner 1951), continue sporatically with the reports and descriptions of the Spanish through the seventeenth and eighteenth century (cf. Swanton 1942; Griffith 1954), and culminate with the increasing volume of information in the nineteenth and twentieth centuries.

A second major kind of primary cultural information deals with procurement strategy, i.e., the complex of means used to acquire resources and render them fit for consumption or use (Figure 3.2h). Strategies are general economic models (e.g., focal hunting, focal horticulture, diffuse hunting and gathering, etc.) developed through inference from archeological data or by extraction from historical records. Reasoning by analogy is often required here when hard information is lacking or absent in the Upper Sabine Valley. As a matter of fact, many of the procurement strategies inferred are based on data from the larger area of northeast Texas and western Louisiana, where analogy seems to be justifiable because of basic environmental similarities, i.e., "pineywoods hills".

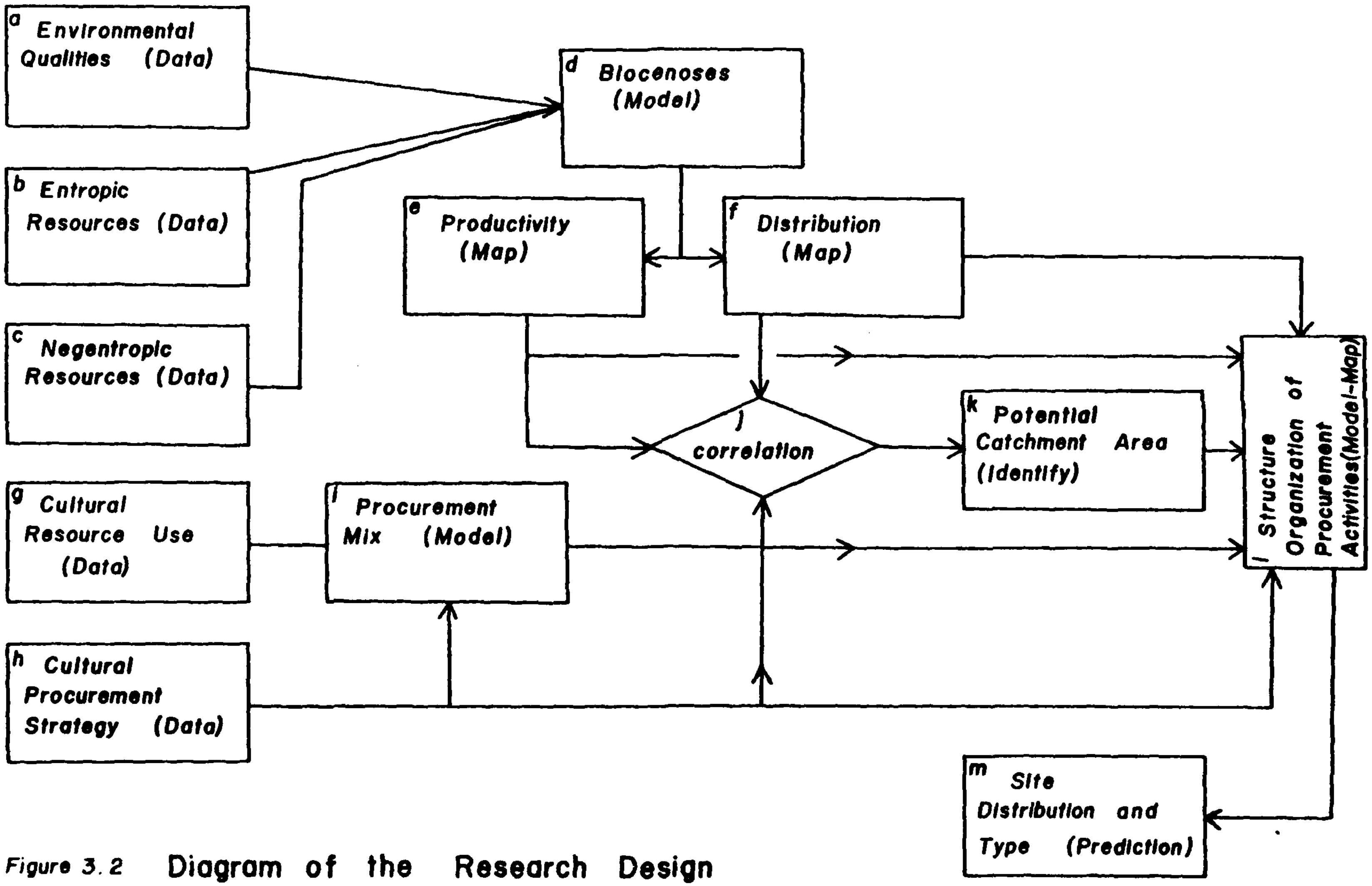

Figure 3.2 Diagram of the Research Design

Since the structure and organization of human activities connected with subsistence have important correlates in the settlement dimension, the outcome of the entire process represented by the research design (Figure 3.2) is the prediction of site locations, densities and types (Figure 3.2m). The relatedness of settlement systems to procurement systems and economic catchments is given by Roper (1979:122):

> . . . human beings are refuging animals, rhythmically dispersing from and returning to a central place (Hamilton and Watt 1970:263), differentially using a seasonally and spatially variable landscape in a manner that generally is conservative of energy, but conservative relative to a relative scale of values placed on needs and wants.

This rhythmic dispersing and returning to a central place normally leaves identifiable residues. Central places are sites of residence. The social nature of humans and the need for shelter means that populations, no matter their propensities for mobility or sedentism, live together in groups and protect themselves from the elements in ways that conserve energy input. Fixed residences, regardless of time spent at any particular locale, are the primary means of satiating these requirements. Group fission or simple dispersement away from residential locations to exploit or produce essential subsistence resources may result in the formation of sites of a more temporary nature. Nonetheless, residues remaining at these spots serve to identify these locales as additional scenes of human activities. If such locales are within convenient distances from fixed residences, they may have no "residential qualities", not even those associated with overnight tenure. More distant sites or those given to some particular time-consuming activity may, on the other hand, exhibit some characteristics of residential areas. Together these spots, where material evidences of human activities remain, constitute the settlement system, or strategy, within a given catchment.

Since the human activity models of various catchments generate the locational, or distributional, aspect of these material and cultural residues, as well as their nature, a predictive dimension results. Transferring such empirically identified catchments to maps of the Big Sandy Creek drainage and viewing these potential catchments in terms of the modeled economic behavior serves two critical purposes. It permits stratification of the landscape for sampling purposes, and, importantly, in terms of scientific dialectics, it allows empirical evaluation of the predictive strength of the catchment approach and its integral models. The former serves to operationalize the field work, the latter directs it, within a true hypothesis-testing framework, toward the acquisition of new knowledge and heightened levels of understanding.

By combining information on resource use and procurement strategy, it is possible to gain another sort of relevant information--procurement strategy mix (Figure 3.2i). A procurement strategy mix represents how a particular group allocates labor in satisfying its basic needs with minimal costs (Earle 1980:14). Mixes are detectible by the proportional combinations of utilized resources. In short, procurement strategy mixes serve to identify the relative values of various resources to group subsistence.

Human adaptability, culture, has been the key to the survival of the species. If a desirable resource is not available, say when a pioneer group moves into a new area, or if overexploitation or extinction diminishes or eliminates a useful resource, alternatives will be found. Thus it is reasonable to assume that environmental qualities (Figure 3.2a) and resources (Figure 3.2b-c) have direct relevance to cultural use of resources (Figure 3.2g) and procurement strategy mix (Figure 3.2i). This relationship is indeed a direct one. It, however, is not deterministic. The nonavailability or diminishing supply of resources in a given locality may be overcome by simply moving to another spot where such resources are available or more abundant or by developing social mechanisms which extend beyond the confines of a residential territory to enable the acquisition of such resources. The research design shows no direct links between environmental factors and cultural factors in these basic categories (Figure 3.2), thus avoiding the label of environmental determinism.

However, the obvious fact of the direct relationship between environment and culture does furnish the rationale underpinning the use of empirically derived catchments as predictors of site locations. By correlating productivity and resource distribution (Figure 3.2e-f) with procurement strategy and strategy mix (Figure 3.2h-i), potential catchment areas can be defined (Figure 3.2k). These potential catchment areas are models of environmental variability that embrace in a relative sense a like amount of subsistence base variability. In other words, potential catchments contain resources in quantities necessary to support the procurement strategy mixes of the occupant group in an efficient manner.

The further fact that these empirically defined catchment areas have a spatial dimension, i.e., they embrace sections of terrain, or landscape, means that the structural-organizational arrangement of procurement activities can be modeled (Figure 3.2l). The distributional aspect of resource productivity (i.e., dispersion, "density", and pattern) across the potential catchment landscape (Figure 3.2e-f) and the known and modeled resource use and procurement strategy mixes (Figure 3.2g,i) of the hypothesized resident population furnish the input for deriving activity structural models once a potential catchment has been defined. Such structural models, operationalized by principles of least effort and economic cost efficiency, produce spatial organizational frameworks with predictive powers for ascertaining where labor (activity) was expended to produce the desired procurement mix.

Research Strategy

Sample Selection

The empirically defined, potential catchment areas contain several biocenoses, or parts of them. Models of procurement strategy mixes of East Texas populations show considerable variability through time as techno-adaptive systems changed. Thus the indicated differences are reflected in differences in kinds and frequencies of exploitative activities of various groups within the bio-structure of catchments. This means that sites, the objectifications of these activities, should vary in location and type within economic catchments.

The sources of variability, represented by the conceptual blocks in the flow diagram (Figure 3.2), furnish the guidance for the delineation of potential catchment areas and the source of site location-type predictions within catchments. The recognition that some "zones" in the Big Sandy drainage are ideally more amenable to one type of procurement strategy mix than another and that some might not be capable of supporting a full range of exploitative activities at all is the basis for sample selection. Thus the Big Sandy drainage can be divided into potential catchment areas and "noncatchment" areas. Noncatchment areas may be defined as those zones incorporating a bio-structure incapable of providing the food and resource needs of a resident population. This is not to say that such zones did not figure in minor ways to procurement systems of groups based elsewhere (for example, the mobile Paleoindian system, hypothesized in Chapter 2), but that populations were not centrally based within them. Even the zones defined as potential catchment areas are not uniform but vary in productivity and geographical distribution of the biocenoses and amount and kinds of edge areas circumscribed by them. Thus the resource structure of potential catchments produces a further kind of variability, that of procurement activities and their settlement correlates. These three sources of variability--potential catchments vis-a-vis noncatchments, resource structure of catchments, and activity organization and settlement distributions--are the bases on which the sample is stratified.

It might be argued that a simple random sample, in which every spot and every combination of spots have an equal chance of being chosen for survey, is the most justifiable approach to defining target areas. However with the limited sample size prescribed by contract (1280 acres, 5.18^{2}km), random sampling is likely to miss some important source of environmental and cultural variability.

A stratified sample, in which various areas are systematically drawn from within strata (i.e., conceptual sources of variability) that are deemed important to the investigation, does, on the other hand, presume that the relative importance of the strata is known. Because there are nearly always empirical, conceptual, and theoretical

bases for selecting strata in the first place, a stratified sampling approach is either implicitly or explicitly linked to some reasoning process underpinning the relational values of the strata in contributing to understanding of some particular research problem or question.

It is exactly this kind of theoretical demonstration--hypothesis-testing--that is sought in the Big Sandy sample. The empirical catchment approach, operationalized here, assumes that the three sources of variability-contributing agents, defined above, have powers for predicting site distributions and the nature of sites. Thus a stratified sample, drawn across the three categories (strata), should permit testing of this assumption.

The research strategy is expressed diagramatically in Figure 3.3. Simply, implementation of the strategy flows through the following sequential steps:

1. Catchment and noncatchment areas will be selected by delineating the proportional mixes of biocenoses within the Big Sandy Creek drainage (Figure 3.3a-b). Where certain tracts seem to fit the environmental and procurement strategy mix combinations, exposed empirically by pre-field work compilation of data, they will be encircled as potential catchment areas. Areas lying outside these circles will be defined as noncatchment areas.

2. After potential catchment and noncatchment zones are selected, procurement activity structure, based on strategy mix models, will be considered in light of the peculiarities of individual catchment zones (Figure 3.3c); this done in order to gain some appreciation of where sites might be located. Noncatchments will have no projected activity structure because, by definition, they supported no centrally based procurement activities.

3. Once these tasks have been done and the potential catchment and noncatchment areas have been transferred to maps of the Big Sandy drainage, a systematic sample totalling 1280 acres (5.18km^2), which explores the three main sources of variability, will be drawn (Figure 3.3d). The locations of these individual survey tracts will be identified on the maps; their limits clearly marked; and access to them will be recorded.

Field Methodology and Data Acquisition

Actual fieldwork will involve a wide range of methods and techniques for acquiring relevant data. It will also require a limited amount of in-the-field classification and identification of material cultural residues, in order to adhere to the contract stipulation: "No collections shall be made except as deemed necessary by other scope of work requirements." Comprehensive records shall be kept of labor expenditure (crew sizes, time spent, manhours, etc.), on-the-ground deployment methods (e.g., transect spacing intervals, locations

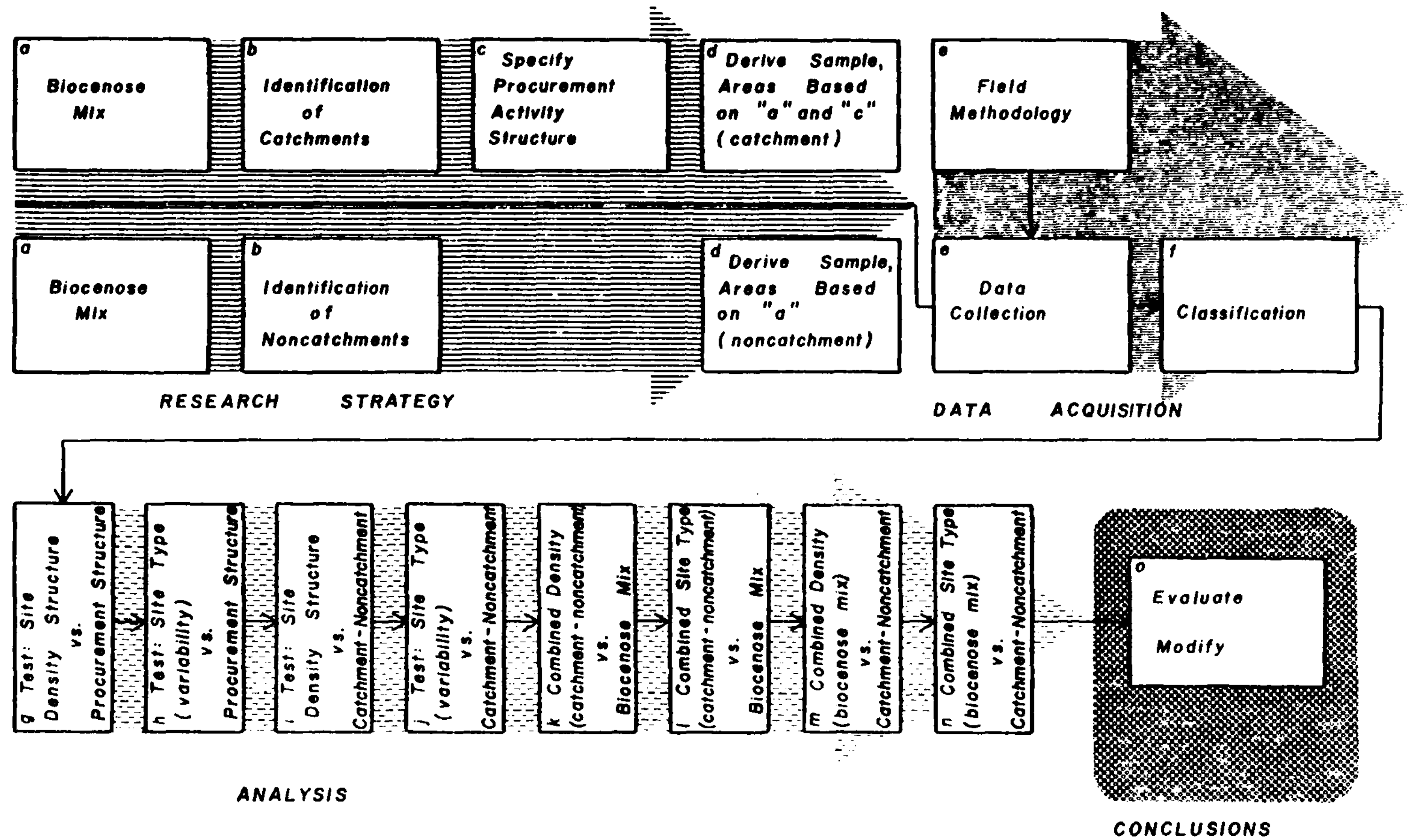

Figure 3.3 Flow Diagram for Research Strategy, Data Acquisition, Analysis, and Conclusions

of test holes and spots of ground clearing, ground coverage alinements and size and pattern of survey tracts), natural conditions encountered along survey paths, and any other factors that might affect site discovery and provide some bases for projecting labor and time imput into similar future reconnaissances or surveys.

In terms of field crew size, some flexibility must be exercised. For most and possibly all of the field tasks, a two-man survey team will be deployed. Since areas to be subjected to on-the-ground coverage will be linear corridors, or transects, and will be relatively narrow, comprehensive coverage should be permitted by a two-man team. The actual location of survey paths within transects will form patterns commensurate with the shape of the transect, but the spacing between the paths themselves will be uniform. Some transects, for example, may only harbor two paths; other wider ones, may have four, six, or further multiples of two. The object of uniform spacing is to insure similar coverage intensity of the ground surfaces from survey tract to survey tract.

Access to the separated survey tracts will be gained by an all-terrain vehicle, but coverage within the tracts will be accomplished on foot. Along each pedestrian alinement, certain tasks will be performed. Time records will be maintained for each kind of major activity, e.g., walk-through, ground-clearing, testing, site investigations, etc. Large scale sketch maps, adapted from 7.5 minute quadrangles, will be used to plot the locations of photographs, observational notes, test holes, and ground cover sweeps, as well as site locations and any other relevant information. In compliance with the scope of services, test holes will be excavated primarily where geological evidence reveals recent, possibly cultural, resource-masking alluviation or colluviation.

Off-site information to be recorded, in addition to the above, will include alinement details of soil-sediment classes and distribution, vegetation type and extent, animals, and terrain-topographic subtlities that do not show on quadrangle maps (e.g., slope, elevation, microtopographic features of drainage, erosion, etc.). In addition, information of the kind and distribution of rocks, if present, will be collected and recorded on the field maps. Other details, particularly those related to terrain alteration by both natural and human agents, will be supplied and mapped.

When material cultural residues are encountered along the alinements, other types of data collecting activities will be activated. To avoid disturbing fragile site patterns, artifacts and features will first be flagged. These items will then be plotted by compass and tape and transferred to a detailed site map which shall also portray the additional environmental information described above. All measurements will be taken from a fixed point which shall be marked by a nonperishable, but nonattention drawing, device that shall also serve to identify the location for future reference. Artifacts will be field classified and returned to their original locations when necessary details have been recorded. When, in the judgment of the field supervisor, such details can be better appreciated by additional study,

these artifacts will be removed, and marked to within two meters of their original location.

On sites where a relatively large number of artifacts must be removed and/or where artifact densities are high, a tape and compass grid of two meter squares will be set up. Artifacts will then be field checked and removed or returned according to the gridded framework.

Such horizontal control will enable the drafting of site maps showing the limits of artifact distribution (hence site "boundaries" and orientation), the relevant siting variables (relationships between terrain layout and artifact distributions), and the contouring of artifactual patterns which may reveal the locations of activity areas and/or post-depositional influences (A-A transforms, Schiffer 1976) that have produced the current physical artifactual distributions.

On sites where high artifact densities would prohibit the classification and locational recording of every object within the project time frame, a sampling plan will be designed in the field. Sampling plans shall insure that all site areas are included and that samples and analytical statistical tests are compatible from site to site.

Determinations of whether or not test units will be excavated will be left to the discretion of the field supervisor. Guidance in these decisions will come from recognition that the individual site situation either has or has not produced the necessary information required by the research design. There is no set a priori rule on which testing is predicated. Site testing per se is not a requirement of this contract but may be done to facilitate the collection of desirable information.

If testing is conducted, the size, placement, and number of excavation units will be determined by field situations. Matrices will be shoveled or troweled and will be screened through one-quarter inch (.63cm) hardware cloth. Levels will be maintained preferably by natural stratigraphy or less desirably by arbitrary controls. Column samples will be saved for futuristic sediment, pollen, or other constituent identifications and analyses. Carbon samples will also be collected if derived from short-term features (e.g., hearths, storage pits, post molds, etc.) or if massed in large quantities along stratigraphic laminae in test pit walls. However, identification and analysis of these materials is beyond the scope of this contract. Profiles of the two conjoined walls nearest site datum will be photographed and drawn. Level floors will be scraped to reveal features, and plats of floors will be prepared if such features are detected. Disturbances within excavation units that may have affected the disposition of cultural materials will be noted. Artifacts and other material cultural residues will be saved and bagged according to provenience. Units will be back-filled and returned, as nearly as possible, to their pre-excavation condition.

For purposes here, there is no preestablished rule of thumb about what constitutes a site or a nonsite. The presence of an artifact, a feature, or a construction is sufficient reason to identify any location as deserving of the intensified investigative procedures described above. Thus in this sense, a single artifact serves to define a "site". It is the nature of that artifact or artifacts, features, and constructions and their densities, dispersions, and patterns that will determine whether the location marks a locus of significance with regard to the loss, discard, or abandonment behavior of peoples who "owned" the items or is indicative of de post-facto activities. In other words, the pronouncement of what constitutes a "site" is an analytical procedure not a consequence of simple recognition based on a preestablished criterion for identification.

Quite obviously the kinds and numbers of material cultural residues do have behavioral correlates and do condition the kind and intensity of investigative procedures. A single dart point, for example, has behavioral dimensions. It could represent a weapon lost by a solitary deer hunter. It might signal only transport from its original position relative to the behavior of its maker and user to another position relative to the "behavior" of post-depositional natural agencies, cattle, or small boys "sailing rocks", but the fact remains nevertheless that it occupies a place on the landscape and that place, regardless of the relevant behavioral correlates, represents a "site" in the real meaning of the term. It is equally obvious that situations, such as the isolated dart point example, cannot be treated exactly as "sites" exhibiting larger numbers of artifacts and myriad behavioral contexts. Such "sites" do not have specifiable boundaries, or limits, that can be mapped in the normal sense, i.e., maps that show the extent of artifacts or midden. To derive area, at least three artifacts are necessary, and, to be behaviorally meaningful, the artifacts must be "related" in a temporal and functional sense. Three artifacts, for example, that derive from different time periods, have no necessary behavioral relationships and thus can not be used to determine site limits.

So, in effect, the term site, as used here, means any place where one or more artifacts or where other material cultural residues occur. The behavioral correlates of such places (i.e., sites in the cultural meaning of the word) are determinable only through analysis.

Acquisition of field information provides both the materials (raw uncounted information) for analysis and is part of the initial analytical procedure itself (Figure 3.3e). Since some, perhaps a large proportion, of materials classification will be done in the field, data simplification (i.e., classification as an initial step in analysis) can be said to begin in the field effort itself.

Further data simplification will transpire in the lab, where collected materials will be conceptually transformed (classified) into units amenable to statistical manipulation (Figure 3.3f). There joined with other relevant information, produced through field work and

independent sources, they will provide the input into the analytical process. Classifactory and typological methods and categories used in data simplification will be described when appropriate.

Data Analysis

To a large degree, the numbers of data collected will determine the kinds of manipulative procedures used. However, the analytical process itself will remain constant. The process is based on comparisons among the several variables, specified by the research design; comparisons facilitated by the use of various statistical tests. Flexibility in the statistical analytical program must be insured to handle the potential problems created by numerically small data categories. Such problems are almost certain to appear because of the small contract-stipulated, size of the area to be surveyed; the 1280 acres ($5.18km^2$) to be subjected to field inspection represents about 0.78 of one percent of the total study area. If site density figures, produced by previous investigations in the Sabine Valley (cf. Gibson 1978) have any relevance to the Big Sandy Creek region, we might expect to find anywhere between five and twenty-seven sites in the sampled tract. If numbers on the lower end of this scale of expectations are realized, then certain statistical tests, requiring frequencies of a certain order (cf. chi-square) may not be reliably used, and other manipulative methods may have to be resorted to.

Regardless of the type of statistical tests to be used (to be described where appropriate in the analysis section), the following eight comparisons are projected as relevant:

1. Site density, or distribution, will be compared with predicted procurement activity structure within empirically defined catchment areas (Figure 3.3g);

2. Site variability will be compared with predicted procurement activity variability within empirically defined catchment areas (Figure 3.3h);

3. Site density or distribution data (from combined biocenose strata) will be compared across catchment and noncatchment areas (Figure 3.3i);

4. Site type (horticultural _vs._ nonhorticultural) will be compared with distribution within catchment or noncatchment areas (Figure 3.3j);

5. Site density or distribution data (from both catchment and noncatchment areas) will be compared across biocenose strata (Figure 3.3k);

6. Site density or distribution data will be compared across catchment *vs*. noncatchment areas by biocenose strata (Figure 3.3l);

7. The distribution of site types (horticultural *vs*. nonhorticultural) will be compared across catchment types (horticultural *vs*. nonhorticultural) (Figure 3.3m);

and in order to test for interaction effect,

8. The distribution of site types (horticultural *vs*. nonhorticultural) will be compared across catchment *vs*. noncatchment areas and by biocenose strata.

Evaluation

The results of this battery of eight comparative exercises should furnish the basis for determining the validity and predictive powers of the empirically derived models. If models are supported, the findings will have relevance to the entirety of the Big Sandy Creek drainage and will serve as the foundation for survey phase recommendations (Figure 3.3o). In such an event, it will be important that survey data be acquired via a comparable approach in order to render the data from the two stages of investigation compatible. If the models only tend to be supported, then they will have to be refined before being used to draft expectations about the whole drainage system (Figure 3.3o). Should analysis fail to support the models at all, then modifications and/or alternatives will have to be considered.

SUMMARY

The Big Sandy Creek reconnaissance is given to the empirical identification of potential economic catchment areas. Sample areas to be surveyed are based on these approximations. Data acquisition is guided by this approach, and analyses are designed to test the validity of the adaptive models, drawn from available archeological and historical data from the general East Texas-West Louisiana area.

CHAPTER 4

CONSTRUCTING THE CATCHMENT MODELS

INTRODUCTION

To establish the sampling strata and provide an experimental context for evaluating the pattern of on-the-ground cultural resources, two different kinds of empirical catchment models have been constructed. The stuff of which these models are made has been discussed in Chapters 2 and 3. There remains the need to set forth the precise content and dimensions of these comparative constructs and the methodological operations which were used in their formulation. It is also necessary to specify the reasoning and methods used in placing these empirical catchment areas over the Big Sandy landscape in order to insure the prospect of independent replication.

The heuristic nature of these models should be reemphasized. The patterns of subsistence and settlement in the Big Sandy drainage are unknown. There have been no intensive investigations in the area prior to the present reconnaissance. Some sites from within and near the area have been reported (Carolyn Spock, Texas Archeological Research Laboratory, communication to Jon Gibson, 21 October 1980); these break down thusly: Archaic, one; Sanders Focus, one; Titus Focus, two, possibly three; Historic Caddo, one; Euro-American, eight; and unassigned, six. Data on these sites are minimal, certainly insufficient to draw any meaningful conclusions on subsistence and settlement patterns. While these sites do help establish the presence of occupations in the Big Sandy area during certain culture periods, they offer little other substantive data on broader land use patterns, and aside from helping to position certain of the potential catchment areas on the survey maps (i.e., guiding the physical delimitation of sample strata), they have not influenced the conceptual or methodological derivation of the potential catchment zones themselves.

The present approach differs from that used in other settlement studies in East Texas (e.g., Bruseth et al. [1977] at Lake Fork Reservoir, by Anderson [1972:121-197] at Lake Palestine, and by Hyatt and Mosca [1972] at Big Pine Lake). All of these efforts started first with the survey fieldwork and used the resultant site distributional information to infer settlement patterns, which were then used, in some cases (Bruseth et al. 1977; Anderson 1972), to compare with models of hunters and gatherers or historic Caddoan horticulturalists (Hasinai) derived from cultural anthropological or ethnohistoric literature sources. While such studies are valuable in giving archeological dimensions to known adaptive and settlement systems and

in aiding in filling in unrecorded details, they mainly serve to demonstrate what is already known. They are exercises in archeological dialectics and though often persuasive, they lack explanatory and predictive powers. Furthermore, since such studies are usually done at the conclusion of the intensive survey stage of cultural resources projects, their inherent ability to extrapolate (not predict) site locations to unsurveyed sections of construction areas is never developed because theoretically the entirety of the area has already been examined. They form the conclusions of cultural resources surveys, not the foundation of the surveys.

The present approach reverses this procedure and moves it up one stage in the cultural resources investigative process. Instead of doing the fieldwork first and comparing the results with documented settlement-subsistence systems, the Big Sandy reconnaissance has used the documented adaptive patterns and the ecological productivity of the drainage basin to choose (predict) the most logical places where certain kinds of subsistence activities took place, and consequentially where and what kinds of sites will occur. In other words, potential catchment zones have been established, and these will be used to determine not only where field investigations will transpire but to predict site distributions and site variability. The field reconnaissance will actually be a test of the predictive powers of the subsistence-settlement constructs, and the degree-of-fit will furnish the basis for determining their validity and/or the need for reevaluation and refinement.

The present approach is operationalized by asking the question--where would labor intensive horticulturists (and alternatively, nonhorticultural, hunters and collectors) live and work to provide the best living possible with the least amount of effort. Since, as will be presently shown, the essential resources and procurement strategy mixes between horticulturists and hunters-collectors differ in many ways, these two adaptive systems furnish the bases for the empirical catchment models. Just because only two catchment models are constructed does not mean that only two homogeneous adaptive systems are suspected for the Big Sandy locality. As a matter of fact, several different modes of adaptation for both Native Americans and Euro-Americans have been discussed in Chapter 2. It is beyond doubt that subsistence and settlement differences existed among the nonhorticultural groups (e.g., Paleo-Indian, Archaic, and Pre-Caddoan enclaves) who lived and worked in the locality and that differences of a similar order obtained among subsistence farmers (e.g., Sanders, Titus, and white Anglo groups). The formulation of more exacting models of procurement strategy mixes for each of these cultural historical groups is, unfortunately, prevented by the lack of hard information on resources utilized. Consequently we are obliged to work within the parameters of available data. Even here, certain liberties have been taken with the empirical data, and in some cases subsistence-settlement expectations are derived by ecological argument, especially with regard to the hunter-collector model.

In order not to drastically exceed the archeological or ethnohistorical information and to avoid compromizing sound

anthropological inferences, only two empirical catchment models have been formulated. One of these models establishes the subsistence zone most amenable to horticultural groups, the other specifies the potential catchment zone for pre-horticultural, hunting-collecting groups. The generality of these constructs prohibits discrimination among the various subsistence spheres of specific cultural historical groups. In other words, at this stage of understanding, it is not possible to say that one supposed catchment zone is more appropriate to the Sanders focus as opposed to the Fulton Titus focus or to the rural white Anglo pattern, all of which presumably had horticultural subsistence bases. Differences among these adaptive patterns no doubt existed, but their nature and degree cannot be determined at present. The model of horticultural catchment zones thus must be extended to all of these cultural historical units in recognition of the simple commonality that all were subsistence farmers and that their livlihoods and patterns of land use will be more internally similar than those of nonhorticulturists.

By the same token, the subsistence-settlement patterns of nonhorticulturists as a whole favor different kinds of catchment areas, and these areas may, in some cases, not coincide or overlap with the physical locations of the potential horticultural catchments. Finding such noncoincident areas within the Big Sandy drainage will permit the testing of expectations of site distribution and variability of nonhorticultural settlements, but, as above, will not allow us to determine before hand whether the to-be-discovered sites will be Epipaleoindian, LaHarpe Archaic, or Pre-Caddoan.

In a very basic sense, the proposed catchment models are very general. They should permit discrimination between horticultural and nonhorticultural subsistence and settlement patterns but not among the various cultural units which sequentially followed these adaptive modes. However, this initial step toward prediction and empirical testing provides a controlled experiment from which model refinement and understanding may ensue. Even if these tests prove inconclusive, the primary objective of surveying a 1280 acre (5.18 km^2) sample of the Big Sandy drainage will have been accomplished and federally mandated responsibilities to cultural resources management programs will have been effectively discharged.

ENVIRONMENTAL QUALITIES

Guided by the inquiry--where would labor intensive horticulturists and nonhorticulturists live and work to provide the best living possible with the least amount of effort--it is necessary to identify those environmental qualities and resources which attracted populations and provided raw materials and foods. This section sets forth an inventory of those qualities that are considered to have been important to populations regardless of their economic strategies. Various entropic and negentropic resources will be listed in subsequent sections. There is no pretense of comprehensiveness, and

no doubt a much wider array of environmental factors was important to local groups. The qualities inventoried below are common sense variables, and many of them have been found to correlate highly with site locations in other adjoining or environmentally similar regions (cf. Anderson 1972; Thomas and Campbell 1978; Gibson 1978).

Permanent Potable Water

A permanent supply of drinking water is a rather obvious necessity. People simply do not live in areas that lack this essential ingredient. Since water is a fluid and is rather heavy, proximity to permanent streams is a requisite for settlement of extended duration. Watertight containers may alleviate, to some degree, the necessity for immediate bankline living sites, but it can be argued, from the premise of least effort, that occupation areas should diminish in both numbers and length of duration as a direct function of distance from permanent running water sources. This is not to say that sites will not be found in localities that lack potable water. Short-term, mobile activities that produced archeological materials may be expected in such areas because water can generally be found away from permanent streams or small supplies can be carried, but extended duration occupation areas will be limited to areas where drinking water is easily accessible.

The Big Sandy watershed displays an intricate web of major and minor water courses. The dissected nature of the terrain means that practically every "holler" bears a small runoff channel. Where these coalesce, especially when fed by springs and perched water tables, they form permanently flowing arteries. Many of the primary and secondary streams in the watershed are ephemeral in their upper reaches but maintain a permanent flow in their lower reaches. Big Sandy Creek, a major tributary of the Sabine River, is the master stream in the basin. It receives (within the project area) direct inflow from 29 permanent and 33 ephemeral creeks and branches; some of the permanent tributaries drain relatively large sections of the flanking hills, and their flow capacities are not greatly inferior to Big Sandy Creek.

Big Sandy Creek is a complex stream. In some sections, it is entrenched and confined within a single well defined channel. In other sections, it divides into several channels which rejoin some distance below the point of bifurcation. This situation is rather typical of braided streams which exhibit relatively steep gradients. It is also clear that Big Sandy Creek is an underfit stream. It occupies a floodplain created during a period of much increased runoff, i.e., the Deweyville interval. The valley extent and floodplain floor landforms formed by the ancestral Big Sandy Creek furnish major controls for its present course. Braided conditions usually obtain where the present channel enters old Deweyville oxbow and ridge and swale sections of the floodplain. In such areas, Big Sandy Creek loses its identity and forms extensive permanently wet glades and bogs. Tributaries which enter the floodplain in these areas also fail to maintain single channels, but upon emerging from these glades at points which most nearly approach base levels, identifiable channels are again assumed.

Freedom from Flooding and Inundation

The necessity for easily accessible drinking water presumes that populations will establish residential locales in close proximity to running water. Such a requirement is obviously negated by technological improvements, such as wells, cisterns, water tanks, and water pipelines, but to groups lacking such facilities, stream side inhabitation is a practical necessity. Such juxtaposition is not without inherent problems and actual danger, because of periodic overflows (floods) and backwaters (inundation) to which floodplains are subjected.

Thus the need for potable water must be considered in conjunction with the relative security afforded by high ground. Areas subject to flooding and inundation are marked by Gladewater and Nahatche soils. Gladewater clays are confined to the Sabine River floodplain proper and extend only a short distance up Big Sandy Creek. Along Big Sandy and its tributaries, Nahatche clays replace Gladewater soils, but settlement constraints due to periodic water coverage would have been similar.

Although detailed water records for Big Sandy Creek have not been available, extrapolations can be made on the basis of data from the Sabine River. There is a definite periodicity to low and high water stages on the Sabine, and this certainly applies to Big Sandy Creek as well. Extreme low water stage occurs during late July and August, while maximum high water (floods and backwaters) is experienced in March and April (Coastal Ecosystems Management 1980: Table 5).

The relatively high gradient of the Big Sandy floodplain means that the spring high waters may dissipate more quickly than in the Sabine valley proper, and backwaters are probably of little consequence except near the Sabine confluence. However, water may pool for extended periods in the glades and in relict swamps and oxbows.

In addition to the normal seasonal variation in water levels, heavy rainfall, such as often accompanies winter cold fronts, may cause temporary overbank flooding, especially in the lower reaches of tributaries where they emerge from the hills onto the Big Sandy floodplain.

As is obvious, flooding and inundation is highly correlated with elevation. However, the difficulty of ascribing flood-free status to elevation levels within the Big Sandy floodplain is due to the extreme north to south slope, or gradient. Elevations on the floodplain floor drop from 116m above msl in the north to 85m above msl in the south. Thus the single best indicator of flood-prone sections is the presence of Nahatche and Gladewater clays.

Stream Confluences

The conjunction of two streams seems to have been a favored spot for human settlement (cf. Gibson 1976a, 1976b, 1977, 1978; Thomas and Campbell 1978). Why this environmental variable exerted such a powerful influence on selections of residential locales is not understood, but there is no denying the biased presence of pre-modern habitation sites at stream confluences. Gibson (1976a:90) has made several suggestions concerning the advantages of stream confluence locations, but the primary value of such spots may have been related in some way to the edge phenomenon (Odum 1971), i.e., higher biomass and diversity of aquatic resources. The value of stream confluence location almost certainly increases as a direct function of the size of the streams involved. Confluences of small hill branches probably offer few adaptive advantages over any other headwater sections because of the biomass gradients associated with lotic environments (Odum 1971). As a general suspicion, the influence of stream confluence location on settlement founding decisions probably was stronger at junctions of larger streams nearer the master stream in the drainage system and at entry points into the master stream itself.

Slope

Slope is another environmental variable that assuredly influenced settlement. Level surfaces are far more suitable spots for human activities, especially those connected with residence, than are hillsides and ravine edges. In dissected, hilly terrain, such as characterizes both sides of the Big Sandy floodplain, relatively flat slopes are limited to ridge crests, escarpment edges, colluvial aprons flanking incisions into the uplands, and to isolated spots here and there. Floodplain surfaces are generally flat, but flooding would have posed limitations on site choices. Elevated surfaces with minimal slopes do, however, occur in the Big Sandy floodplain. These correspond to alluvial cones, formed by tributary splay onto floodplain surfaces, to relict levee ridges, and to accretion belt features. These elevated landforms with relatively level (and consequently inhabitable) summits are predominantly products of Deweyville deposition.

Environmental Edges and the Edge Effect

The edge phenomenon (Odum 1971) has already been mentioned in connection with stream confluences. Edges refer to the conjoining of two or more habitats along a common boundary. Generally edges are thought of as physical features, and indeed there is a spatial, or geographic, dimension to edges, i.e., they can be mapped. However, the important thing about edges is that they circumscribe zones of conjoined ecosystems and ecosystems are processes. There are diurnal, seasonal, cyclical, and irregular fluctuations in ecosystems, and these

have profound influences on the narrow zones of common geographic occurrence. In other words, environmental edges are constantly influx, changing in both nature and physical extent, depending on the energy flow and tropic webs and levels associated with them (Odum 1971). Because of the complexity of edges in the Big Sandy drainage basin, no attempt will be made to list all of the different types nor their associated and changing qualities. It should suffice to say that edges, because of the heightened biomass and faunal and floral diversity correlated with them, offer certain advantages to extractive economies.

As a working premise, edges and edge effects are considered to have influenced the distribution of human activities, including residence, in the following way. Exploitation of floral and faunal resources in edge situations, by affording access to a wider variety and larger number of biotic species, would have enhanced the potential for food extraction and would have made exploitative activities more efficient (in terms of least effort) by concentrating labor in restricted areas. By positioning residential locations in those areas where ease of access to environmental edges was assured, exploitative labor and transportation costs could have been reduced and economies streamlined.

It is also anticipated that the economic advantages of edges would have been a more significant influence on nonhorticultural peoples whose sustenance was gained from wild biotic resources. As the role of wild food stuffs diminished with the increasing dependence on cultigens and domesticated animals, the value of environmental edges would have diminished commensurately.

Arable Soils

Of critical importance to gardeners and farmers are arable, fertile soils. In terms of fertility, soils in the Big Sandy drainage basin are quite variable. A general idea of fertility may be gained from capability classes assigned by the U.S. Soil Conservation Service (Lane 1977:6-28). This classification system is not strictly based on yield per hectare information but integrates a variety of other considerations which result in a system of rank ordering of various soil types for agricultural propensities (Lane 1977). Even though these capability class assignments are based on contemporary farming techniques, modern hybrid strains, and soil improvements, they should give a relative idea about soil productivity. On the basis of these evidences, the soils in the locality can be rated for horticultural potential in the following order (highest to lowest):

1. Freestone and Bernaldo fine sandy loams are rated highest among the major soils of the study area, but their assignment to class IIe (Lane 1977:9, 12) means that even they have limitations for cultivation. The major problem with these soils is erosion.

Both types occupy small (range about 4.0 to 400 ha, average 18 ha) irregularly shaped areas on narrow ridges and interstream divides.

2. Wolfpen loamy fine sand rates second in capability (Lane 1977:22). This soil type occupies oval shaped tracts on ridge tops and interstream divides in the uplands; tracts are usually small, ranging between 8.0 and 16 ha in size. The major drawbacks of Wolfpen soils are the inability to retain fertility with continual cropping and the only moderately available water capacity (Lane 1977:22).

3. Woodtell loam and Kirvin gravelly fine sandy loam at best rate only marginally capable of supporting farming. Inherent limitations of these loams are erosion (due to moderate to steep slopes) and the often rocky composition (Lane 1977:16-17, 22-25). Both soils are restricted to uplands; Kirvin soils are usually found around the slopes of oval landforms, while Woodtell loams are generally restricted to slopes of linear features. Plots are usually small, ranging from about 3.0 to 120 ha in extent, and average between 12 and 20 ha.

4. Gladewater clay and Nahatche clay loam are placed in capability class V by Lane (1977:12-13, 18-20), which means they are practically unsuited for cultivation. While these soils are fertile and rich, they are poorly drained and too wet for cultivation. They are also subject to flooding, both seasonally and meterologically. They occur primarily as linear tracts paralleling drainage arteries in the lowlands, ranging from plots of some 8.0-10 to over 800 ha in size.

NEGENTROPIC RESOURCES: DATA PRODUCTIVITY, AND DISTRIBUTION

Plant Foods

Table 4.1 lists the potentially edible wild plants endemic to the Big Sandy drainage system. Also included is habitat information and a relative abundance factor abstracted from U. S. Army Corps of Engineers (1976a), St. Amant (1959), Brown (1945), Gould (1969), Blair (1950), and Ecosystems Management (1980). Inclusion on the list of edible wild plants is based on Gibson (1970b),Medsger (1939), and Angiers (1974).

TABLE 4.1. Edible Wild Plants, Habitats, and Abundance in the Big Sandy Drainage

Species	Habitats		Abundance*
Acorns:			
Laurel oak	Wet woods	B	C
Overcup oak	Moist woods	I	C
Burr oak	Moist woods	I	C
Water oak	Wet woods	B	A

Species	Habitats		Abundance
Willow oak	Moist woods	I	A
Shumard red oak	Moist woods	I	C
Blackjack oak	Uplands	S	A
Post oak	Uplands	S	A
Cow oak	Uplands	S	C
Chinquapin oak	Uplands	S	C
Black oak	Uplands	S	C
<u>Nuts</u>:			
Butter pecan	Swamps		C
Pecan	Moist woods		C
Butternut hickory	Wet woods, hills		C
Swamp hickory	Wetwoods, swamps		C
Shagbark hickory	Rich woods, slopes, stream banks		C
Black hickory	Dry woods, rocky slopes		C
Mockernut hickory	Dry and moist woods		C
Black Walnut	Rich woods, clearings		C
<u>Fruits</u>:			
Little-hip hawthorn	Wet woods, clearings		C
Hawthorn	Sandy stream banks		C
Green hawthorn	Wet woods, clearings		
Tree huckleberry	Uplands, clearings, stream banks		C
Rusty blackhaw	Open woods, edges, stream banks		C
Persimmon	Dry woods, clearings		A
Red mulberry	Uplands, floodplains		A
Mexican plum	Floodplains, prairies, edges, lake and stream banks		C
Plum	Rich woods, edges, thickets		C
Flatwood plum	Edges, slopes, creek banks		C
Elderberry	Edges, floodplains		C
Sweet grape	Water margins		C
Riverbank grape	Water margins		C
Fox grape	Edges		C
Pinewood grape	Open woods, thickets, glades		C
Muscadine	Open woods, water margins		C
Louisiana blackberry	Moist sandy thickets		C
Bailey's blackberry	Piney woods		C
Dewberry	Thickets, edges, stream banks		A
<u>Other</u> (seeds, roots, leaves-stalks, etc.):			
Honey locust	Floodplains		A
Winged sumac	Everywhere		C
Smooth sumac	Sandy uplands, sandy stream banks		C

Species	Habitats	Abundance
Palmetto	Nonflooded lowlands	C
Saw greenbriar	Everywhere	C
Common greenbriar	Thickets	A
Bristly greenbriar	Thickets, creek banks	C
Red bead greenbriar	Swamp thickets	C
Western ragweed	Bottoms, disturbed areas	A
Giant cane	Stream edges	A
Bullnettle	Open woods, prairies	C
Panic grass	Moist meadows	C
Switch grass	Moist meadows	C
Dandelion	Clearings, disturbed areas	C
Cattail	Lentic water	C
Dock	Rich woods	?
Evening primrose	Dry, sandy slopes	?
Ground nuts	Rich woods	?
Jerusalem artichoke	Rich woods	?
Wild onion	Rich woods	?
Pigweed	Clearings, disturbed areas	A
Plantain		?
Jack-in-the-pulpit	Rich woods	?
Purslane	Disturbed sandy areas	?
Sorrel	Rich woods	?
Goosefoot	Edges, disturbed areas	A
Milkweed	Clearings, disturbed areas	C
Solomon's Seal	Lentic water, wet woods	?
Arrowhead	Lentic water	?
Pokeweed	Rich woods, moist woods	C
Indian turnip	Rich woods, moist woods	?
Chufa	Wet woods, floodplains	A
Wild potato	Clearings, disturbed areas	?
Marsh elder	Edges, disturbed areas	C
Smartweed	Clearings, disturbed areas	A
Passion flower	Clearings, disturbed areas	?
Paw paw	Rich woods	?

*A, abundant; C, common; U, uncommon

These plants could have provided year-round foods, but there are definite seasonal implications in this floral aggregate. Figure 4.1 summarizes the seasonality factors in terms of general categories, i.e., nuts, acorns, seeds, roots, fruits, and other.

Seasonality of Wild Plant Foods

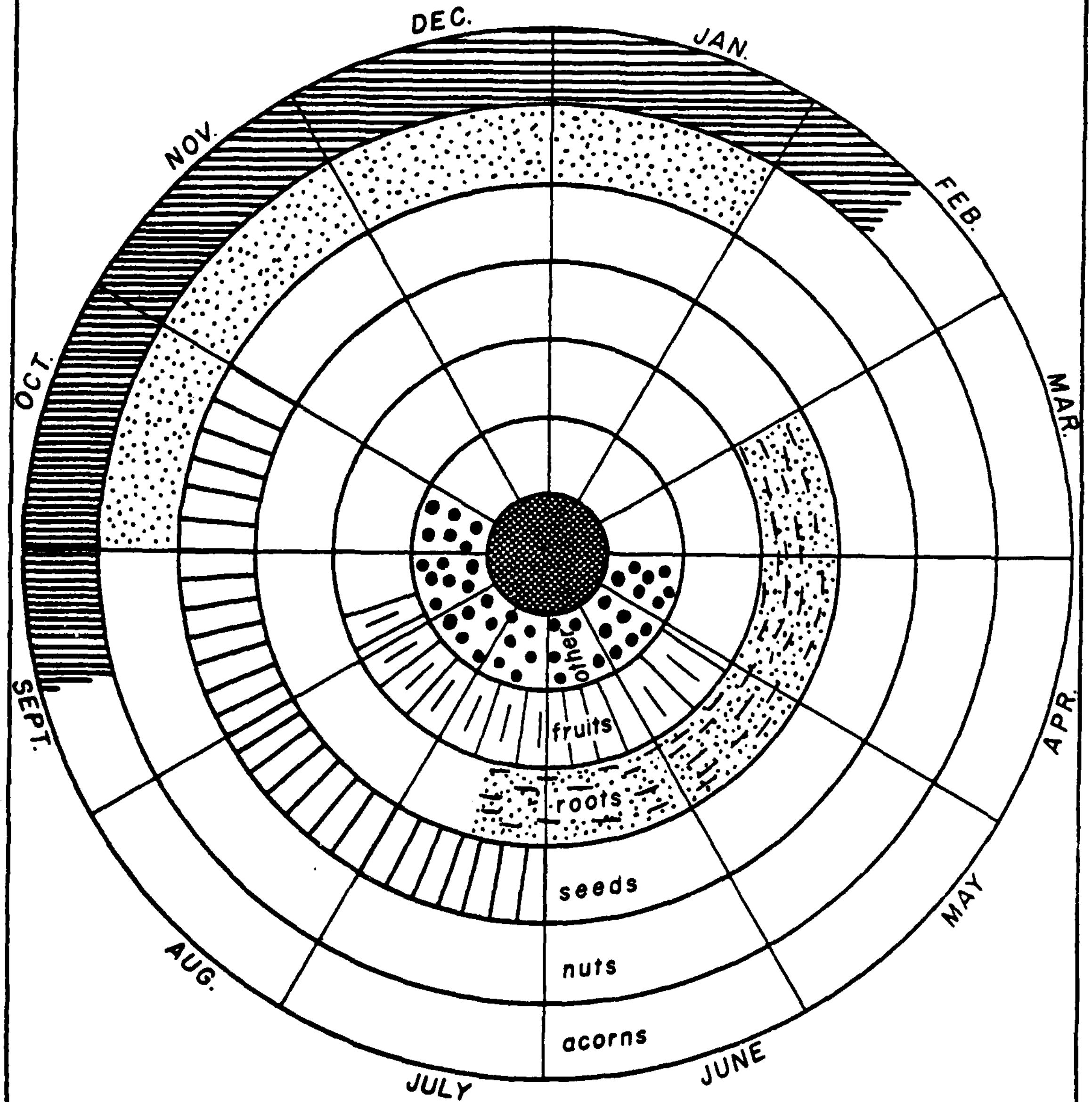

Figure 4.1

Acorns

In East Texas, seedfall begins in September and concludes in late January-early February (Goodrum et al. 1971:521), peaking during November and December. It is during maximum seedfall that acorns would have been most accessible to collectors.

Acorn yields vary by species, by annum, and by size of tree. Productivity increases generally as size (and age) of the tree increases (Goodrum et al. 1971:Table 4). Annual variations in yield were extreme: white oaks (i.e., cow, white, and post) average one good crop every two years, sandjack and water oaks generally have four good mast years every six years; blackjack produces one good crop every five years; and southern red oak has one good year every four (Goodrum et al. 1971: 525). There is no apparent annual cycle in mast production; neither does there seem to be years of complete mast failure. Some of the trees produce acorns yearly despite low overall productivity.

White and red oaks also have variable yields and acorns exhibit caloric differences. Presented in Table 4.2 are the yield ranges of various oak species in East Texas, based on a longitudinal 18-year study by Goodrum et al. (1971:Table 5).

TABLE 4.2. Acorn Yields by Species Expressed in Kilograms per Tree per Annum

Species	Minimum	Maximum	Average
Cow oak	.45	3.73	2.50
Post oak	.03	4.41	1.43
White oak	.32	6.05	3.20
Blackjack	.04	1.09	0.30
Sandjack	.32	1.91	1.25
Southern red oak	.02	7.64	1.56
Water oak	.41	5.59	3.20

Goodrum et al. (1971:Table 6) have also recorded the percentage of mast-producing trees per annum, and these averaged percentages breakdown thusly: cow oak, 60 percent; post oak, 62 percent; white oak, 49 percent; blackjack oak, 62 percent; sandjack oak, 90 percent; southern red oak, 61 percent; and water oak, 78 percent.

These data make it possible to calculate average total productivity if species density were known. However, gross productivity is an inaccurate measure of potential value to human consumption. Net productivity is a more sensitive indicator. Deer, squirrels, quail, crows, jays, woodpeckers, turkey, raccoons, rabbits, and gray foxes compete for the acorn crop (Goodrum et al. 1971:527-528). It has been

determined that avian and arboreal feeders take about 13 and 14 percent respectively of the annual acorn yield (cf. Goodrum et al. 1971:522). Once seedfall begins, ground feeders also take a heavy toll. Thus humans would have had stiff competition for the annual acorn crop.

Other factors could potentially have influenced human exploitation of acorn mast. White oaks typically have larger acorns than red oaks. Cow oaks average 103 acorns per kilogram; white oaks, 227/kg; and post oaks, 475/kg. For the red oaks, acorns/kg distribute thusly: blackjack, 497; sandjack, 506; southern red, 695; water, 724; and willow, 928 (Goodrum et al., 1971:Table 1). Collecting larger acorns would have certainly required less labor and time than smaller ones. In addition, white oak acorns are sweet and have less tannic acid than red oak acorns. Thus less preparation would have been required to render the larger, sweeter white oak acorns palatable. The facility of all acorns for long-term storage should be mentioned as well. Storage may have accomplished two principal ends. First, it would have obviously extended their period of accessibility and use, particularly through winter and possibly spring. Second, storage would have cut down or eliminated the leaching necessary to rid the "bitter" varieties of their tannin content (cf. Angier 1974:34). Acorns buried in mud or sand, until their shells turn black, are rendered palatable without extensive leaching (Angier 1974:34).

Nuts

Several species of nuts would have been available in the Upper Sabine Valley. These include the pecans, the hickories, and black walnut (Table 4.1). To this list should also be added the chinquapin, a species also rarely encountered in the region today but once more plentiful.

Like the acorns, nuts may be either sweet or "bitter", the "bitter" forms obviously requiring more preliminary treatment to make them edible. The pecan, shagbark hickory, mockernut hickory, pignut hickory, swamp hickory, black hickory, and chinquapin have sweet meats, while the bitter pecan and the bitternut hickory have "bitter" meats (cf. Brown 1945:43-55; Medsger 1939:98-105).

Annual yields and limiting factors are unknown for the region, but in good years from 0.5 to 1.0 bushel (17-35 liters) of nuts per tree have been collected (Medsger 1939:100, 103). From the best trees in good years, this could mean as many as 700-1400 nuts per tree for pecan, bitter pecan, and bitternut hickory; some 175-350 nuts per tree for shagbark and mockernut hickories; and 350-700 nuts per tree for swamp, pignut, and black hickories (calculations based on nuts sizes given by Brown 1945:43-55). If similar yields pertain to the black walnut, then from 140 to 280 nuts per tree might be expected. A bushel of the smaller chinquapins would hold some 5600 nuts.

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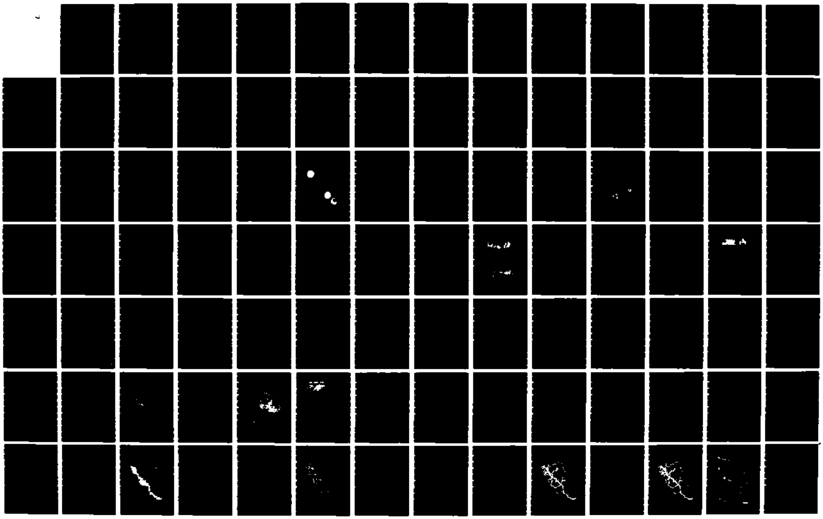

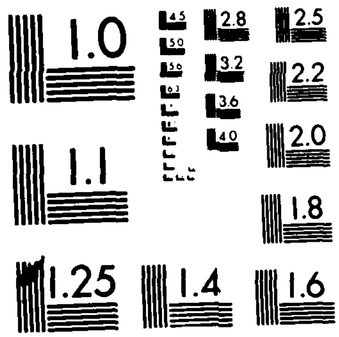

MICROCOPY RESOLUTION TEST CHART
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This volume of nuts, however, cannot be converted directly into edible portions. For the thin-shelled species, such as pecan, about 85-90 percent of the weight and volume represents consumable meat. For the thick-shelled varieties (e.g., mockernut, swamp, pignut, and shagbark hickories and black walnut), this may be reduced to 50-60 percent.

Nuts generally ripen in late September and October, and seedfall for most species is greatest during November and December. Prior to seedfall, this mast is heavily exploited by birds and aboreal mammals, and while on the ground there is intense competition for this crop by various animals. Thus net productivity (i.e., yield minus portions extracted by the various feeders and those "bad" nuts) is a more appropriate indicator of the value of nuts for human consumption.

Nuts are rich in oils and proteins, as well as various minerals (cf. Angier 1974), and have high caloric values. Caloric values (cal/100g) are listed by species: pecan, 786; bitter pecan, 611; pignut, 797; swamp hickory, 603; shagbark, 779; black hickory, 811; mockernut, 738 (Burns and Viers 1973:Table 2); and black walnut, 628 (U. S. Department of Agriculture 1964).

Again like acorns, nuts are easily stored, which would have extended the period of accessibility well beyond the fall and winter, if gathered in sufficient quantities. Since considerable work and time would have been involved in preparing some of these nuts (particularly the thick-shelled, "bitter" varieties), it is expected that their use did continue far past the time when they were actually collected.

Seeds

Seed crops of potential use to human populations in the Big Sandy drainage include honey locust, cane, panic grass, switchgrass, pigweed, purslane, goosefoot, smartweed, ragweed, and possibly others (Table 4.1).

Many of these plants are prolific seeders; for example over 100,000 seeds have been collected from a single pigweed plant and around 75,000 from a goosefoot plant (Angiers 1974). Cane is also a massive seed producer. Unlike the other species which are annuals, cane produces seeds sporatically but can be encouraged and regularized by firing.

Seeds generally mature in late summer and early fall, just prior to the beginning of acorn and nut seedfall. Honey locust seeds ripen and the pods are filled with sweet pulp during September and November.

Honey locust grows on sandy zones in the floodplain. Cane often forms thick, monotypic stands, or "brakes" on sandy soils along creek banks, upland slopes, and ravines. Contrary to popular belief, cane does not grow in flood- or inundation-prone areas; it, in fact, is an

excellent indicator along with palmetto and hackberry of flood-free, elevated areas within floodplains. The other plants are sun-loving, pioneering species. They are among the first plants to invade and colonize disturbed ground. Sands and silts pumped onto floodplain surfaces by overflows are rapidly covered by these "weeds", if sunlight is not obscured from reaching the ground. These plants grow abundantly around animal burrows, eroded spots, and fire-razed areas in the open.

Although quantifiable information on abundance, productivity, and yield is not available, it is safe to say that, if seeds were utilized by Big Sandy residents, they could have furnished important, summer and early fall foods. There is a possible drawback to placing too much emphasis on seed plant abundance and potential human exploitation. Purslane, pigweed, goosefoot, and smartweed make excellent "greens", or potherbs. If these plants were used for "greens" during their tender growth stages in the spring and early summer, when few other plant foods would have been available, it would have certainly cut down on the potential seed harvest.

Roots and Tubers

Edible roots and tubers in the Big Sandy locality include the greenbriars, cattail, dock, evening primrose, ground nuts, Jerusaelm artichoke, wild onion, Jack-in-the-pulpit, Solomon's seal, arrowhead, Indian turnip, chufa, and wild potato (Table 4.1).

Although roots and tubers are obviously available year-round, there are certain factors that influence not only edibility but accessibility. Late season (fall-winter) roots, while "sap-filled", are usually fiberous, or "woody", and would have made less desirable foods because of the more extensive preparation necessary to separate the unusable fibers. Additionally, finding these plants after cold weather has killed the green, above-the-ground parts of the plants could have proved quite difficult. With spring rejuvenation, not only would the plants have been easy to identify, but the tender new growth of the tubers and roots would have rendered them more palatable and easier to prepare (Medsger 1939).

Some of these roots and tubers can be eaten raw or with little or no preparation, e.g., cattail, ground nuts, and wild onion (cf. Medsger 1939). The others would have required treatment, ranging from simple drying to boiling and/or roasting. Conversion into flour would have prolonged the availability of these plant foods.

It should be kept in mind, when considering the possible role played by roots in human diets, that root harvesting kills the plant, and, in the case of greenbriars, cattail, dock, evening primrose, ground nuts, wild onion, and Solomon's seal, which also bear edible shoots, leaves, and/or seeds at different seasons (cf. Gibson 1970b), root harvesting would have eliminated these potential food stuffs at appropriate seasons.

Habitat information on these species is given in Table 4.1 and seasonality (based on Medsger 1939:269-271) is provided in Figure 4.1. Data on abundance, productivity, and yield are quite general (Table 4.1) or nonexistent.

Fruits

An inventory of fruits available in the Big Sandy locality is shown in Table 4.1. Like other wild plant foods, these fruits are available seasonally. Many ripen and last for short periods, while others have more lengthy periods of availability. However, human exploitation of fruits would have had to have been precisely scheduled because of the intense competition from wildlife.

Summer is the main season of ripened fruits (Figure 4.1) (Medsger 1939:259-263; Gibson 1970b). A few species ripen in late spring, e.g., mayhaw, mulberry, dewberry, and some blackberries. Some of these berries may continue into summer where they join the hot-weather maturing fruits, such as the haws, plums, elderberry, huckleberries, grapes, and muscadine. Pawpaws, haws, elderberry, grapes, and muscadine may extend briefly into the fall, and a few species, e.g., hackberry, persimmon, maypop, and black haw, appear first during the autumn. Hackberry, persimmon, and black haw may last into winter.

Other than the general rating availability (cf. Table 4.1), detailed quantitative data on productivity and yield of fruiting species in the Big Sandy locality are lacking. In addition, personal observations made by this author in similar environments in northwest Louisiana indicate that various undisclosed limiting factors affect the annual fruit yield. It varies from year to year, from practically negligible to superabundant. Woody species (tree and shrub fruits) seem most susceptible to these annual variations. Berries, especially dewberries and blackberries, seem relatively immune to these fluctuations and normally produce abundant yearly crops.

A variety of habitats are embraced by fruiting species (Table 4.1). All areas, except the climax pineywoods and the scrub oak woods on hill summits, and the lowest, wettest areas in the bottomlands, would have borne fruiting plants.

Vitamin and mineral rich, wild fruits also have respectible caloric values, generally exceeding those of many cultigens but falling well below those of acorns and nuts. Some examples include (cal/100g): blackberries and dewberries, 58; grapes and muscadine, 69; pawpaw, 85; and persimmon, 127 (Angier 1974; U.S. Department of Agriculture 1964).

Other Wild Plant Foods

Included mainly in this category are those plants, whose tender shoots, corms, leaves, and/or stalks are edible, either raw or after preparation. Plants which fall exclusively into the "greens", or "vegetable" group include plantain, sorrel, nettle, and pokeweed (cf. Medsger 1939; Gibson 1970b). Other "greens" plants also have edible components--seeds, fruits-drupes, or roots-tubers--which are available at various seasons; these include blackberry, greenbriars, palmetto (swamp cabbage), bulrush, dandelion, cattail, dock, evening primrose, grape, pigweed, purslane, sumac, goosefoot, milkweed, Solomon's seal, arrowhead, Indian turnip, and cane (Gibson 1970b; Medsger 1939).

There is a definite spring season availability to this aggregate of plants (Figure 4.1). The new shoots, tender stalks, and young leaves are generally best immediately after these annuals burst forth from the ground following the last frosts and before the plants reach large, mature sizes (Gibson 1970b; Medsger 1939:266-269). By summer, most of these "greens" or "salad" plants are past the tenderlet stage, and some actually become poisonous.

General habitat and abundance information is provided in Table 4.1, but detailed, quantifiable data is lacking. Their value as foods is illustrated by the following selected examples (cal/100g): palmetto (swamp cabbage), 29 (raw), 21 (cooked); purslane, 21 (raw), 15 (cooked); pigweed, 36 (raw); cane shoots, 71 (raw); dandelion, 45 (raw), 33 (cooked); and pokeweed, 23 (raw), 20 (cooked) (U.S. Department of Agriculture 1964). Perhaps more importantly, many of these plants are the richest in vitamins and essential minerals of all plant foods, wild or cultivated. For these additional components, dandelion, dock, purslane, pigweed, and goosefoot rate highest. It is worth mention that these five plants have definite propensities for disturbed habitats, such as would exist around areas of intense human activities.

Not only are the factors of yield and season critical to evaluating the value of these plants to human consumers, but preparation effort must also be taken into account. A few of the plants can be eaten raw, but the majority require boiling in several "waters" to rid them of bitterness and, in some cases, the bristles.

Food Animals

Table 4.3 inventories selected animal species which have in recent times occupied the Big Sandy drainage basin. Abundance factors and habitat information, taken from U. S. Army Corps of Engineers 1976a, 1976b; Ecosystems Management 1980), have also been included.

TABLE 4.3. Food animals, Habitats, and Abundance

Species	Habitat[1]	Abundance[2]	Density animal/hectare
Mammals:			
Raccoon	B,I,S	P	1/4.05
Fox squirrel	I,S	A	1/.607-1/1.05
Gray squirrel	B,I	A	1/.607-1/1.05
Cottontail rabbit	I,S	A	1/1.21
Swamp rabbit	B,I	A	1/1.21
Deer	B,I,S	P	1/4.05-1/6.07
Oppossum	B,I,S	P	1/8.09
Bobcat	B,I,S	O	?
Beaver	B	O	?
Bison	S	O	?
Mink	B	O	1/40.47
Bear			
Birds:			
Canada goose	B	-	?
Whitefronted goose	B	-	?
Snow goose	B	-	?
Mallard	B,I	-	?
Pintail	B	-	?
Canvasback	B	-	?
Teal	B	-	?
Wood duck	B,I	-	?
Woodcock	B,I	C	1/16.2
Quail	I,S	P	1/4.05
Mourning dove	S	A	1/.81-1/2.02
Turkey	I,S		1/54.2
Prairie chicken	S	?	?
Cranes - herons	B	O	?
Rails	B	O	?
Coot	B	C	?
Reptiles:			
Snapping turtle	B	C	?
Softshell turtle	B	C	?
Mud turtles	B	C	?
Box turtles	B,I,S	A	?

Species	Habitat[1]	Abundance[2]	Density animal/hectare
Fish:			
Gars	B	A	450-674kg/hectare
Bowfin	B	P	
Pike	B	C	
Catfishes	B	P	
Buffalo	B	C	
White bass	B	O	
Bass	B	C	
Crappie	B	C	
Drum	B	P	
Perch	B	C	
Shad	B	A	
"Minnows"	B	A	
"Brim"	B	A	

[1]Bottomlands, B; Intermediate Slopes, I; Summits, S.

[2]Abundance categories: A, abundant; P, plentiful; C, common; O, occasional; and R, rare.

This highly selected list of animals is not meant to be comprehensive, only to show those species, as well as some other animals, which appear in archeological or ethnohistorical records of the general area.

ENTROPIC RESOURCES

Entropic resources present in the Big Sandy drainage include various rocks and clays. Lithics include native chert gravels, petrified wood, ferruginous sandstones, siltstones, and mudstones, and ochre. There is no existent information on the precise locations of outcrops or deposits of these materials. However, the Woodtell stony loams, which are generally confined to the hill and divide summits in the locality (Lane 1977), are so named because of the presence of large slabs, boulders, and cobbles of sedimentary origin. Ferruginous sandstones, petrified wood, and ochre occur ubiquitously in the uplands, especially on eroded surfaces where underlying red clayey substrates have been exposed. Pebble cherts appear in gravel trains in Pleistocene formations and landforms and probably in some of the Deweyville features, which are composed of alluvial and colluvial sediments reworked from older Pleistocene exposures.

Clays suitable for pottery manufacture are also widely distributed in the drainage basin. The Gladewater and Nahatche soils of the floodplains and bottoms are highly plastic clays. However, they tend to be highly organic and might not have been as desirable as the upland clays because of the greater effort necessary to prepare them for vessel construction. At shallow depths (generally less than 1.0m) under the sand and loam solums of the uplands are omnipresent red and reddish-brown clays, which probably would have furnished the most desirable source of the ceramicist's medium.

Like the food resources, there is a definite upland orientation to these essential industrial materials.

DOCUMENTATION OF RESOURCE USE BY UPPER SABINE POPULATIONS

With the disclosure of the availability, productivity, and habitat distribution of potentially useful resources, it is now essential to identify those resources actually exploited by groups residing in the Upper Sabine Valley. This information will furnish the detailed input for construction of potential catchment zones and permit such areas to be circumscribed and mapped.

Resource Use by Prehorticultural Populations

Details of biotic and abiotic resource use by prehorticultural populations (e.g., Epipaleoindian, Archaic, Pre-Caddoan) are scanty to say the least. The principal sites from the general area which yielded subsistence data include the Fred Yarborough site, located on a knoll in the Sabine River floodplain in Van Zandt County about 60km west of the town of Big Sandy (Johnson 1962); the Manton Miller site, positioned on a rise in the South Sulphur River floodplain in Delta County, about 70km northwest of Big Sandy (Johnson 1962); and the Resch site, on the upland edge escarpment overlooking the Potters Creek floodplain in Harrison County, some 60km east of Big Sandy (Webb et al. 1969). The Yarborough and Resch sites are within the Upper Sabine River drainage system, just as is the Big Sandy locality; the Miller site is in the Sulphur River drainage. Yarborough and Miller are predominantly Archaic components (i.e., LaHarpe Aspect), with smaller later Pre-Caddoan (Fourche Maline) and Sanders Focus components. The Resch site, on the other hand, has evidence of occupations during Archaic (LaHarpe), Pre-Caddoan (Fourche Maline--Tchefuncte, Marksville, Troyville, and Early Coles Creek), Alto times. The various culture units at these sites are mentioned to allow for the possibility that some of the food remains tabulated below (Table 4.4) may actually derive from later components and thus may not represent prehorticultural residues.

Nonetheless assuming that at least some of the food remains are of Pre-Caddoan and Archaic origin, they are listed in Table 4.4 and provide the basic data on which the prehorticultural procurement strategy mix is formulated.

TABLE 4.4. Food Remains from Prehorticultural Sites

Species	Yarborough	Miller	Resch
Animals:			
Deer	X	X	X
Raccoon		X	
Cottontail rabbit		X	
Terrapene sp.		X	
Turkey (?)		X	?
Ferret		X	
Opossum		X	
Skunk		X	
Dog		X	
Hare		X	
Fish (sp.?)		X	
Mussels (sp.?)		X	
Plants:			
Hickory nuts			X
Black walnuts			X
Pignuts			X

Resource Use by Native Horticultural Peoples

Selected for presentation here are the resources recorded as being used by the Hasinai Caddo of the period between the late seventeenth and early nineteenth centuries. The reason for selecting the Hasinai data is rather simple. The Hasinai information is based on historical observations and is relatively comprehensive (cf. Swanton 1942; Griffith 1954). It is not subject to the same kinds of biases that plague archeological subsistence data, and although the records are rather inexact with regard to quantities and proportional mixes, the qualitative dimension is much broader than that for prehorticulturists.

Two major presumptions underlie the extension of Hasinai resource use information into the Big Sandy drainage. First, the upper reaches

of the Sabine River, while possible not occupied by the Hasinai proper (equated archeologically with the Frankston and Allen foci) was occupied by Caddoan groups (i.e., Titus and unspecified historic foci), who possessed a similar level of technology and comparable population densities. Second, the Big Sandy drainage is environmentally similar to the Hasinai homeland along the Upper Neches River.

With these justifications in mind, Table 4.5 inventories the food and other essential resources utilized by the Hasinai.

TABLE 4.5. Resources Used by the Hasinai Caddo as Abstracted from Griffith (1954) and Swanton (1942)

Foods (Wild Plants):	Foods (Wild Animals):	Industrial Resources (Wood):
nuts	deer	
acorns	bear	mulberry
chestnuts	rabbits	cedar
persimmons	bison	osage orange
plums	wildcats	walnut
wild grapes	badgers	cane
white mulberries	mice	reeds
red mulberries	turkeys	
blackberries	partridges	Industrial Resources (Bone):
maypops	quail	
herbs (?)	prairie chickens	
roots from shrub (like sweet potatoes)	ducks	crane
	geese	
ground nuts	bustards	Industrial Resources (Shell):
reed seeds (?)	cranes	
grass (?)	fish	
		unspecified mollusks
Foods (Cultivated Plants):	Foods (Domesticated Animals):	
		Industrial Resources (Skins & Feathers):
maize (2 varieties)	chickens	
beans (5-6 varieties)	turkeys	
sunflowers		deer
gourds		bison
canteloupes		turkey
watermelons		rabbit
peaches		
plums		Industrial Resources (Stone):
strawberries		
pomegranates		
		flint
		red ochre

Resource Use by Other Groups

The Big Sandy locality has been occupied since the first part of the nineteenth century by non-Indians of various racial, ethnic, and national origins, predominantly of Upland South extraction. Plant and animal husbandry furnished the principal means of subsistence, as well as of commercial enterprise, though some use was made of the natural wild resources of the area (cf. Chapter 2). With the intensification of commercial farming and ranching, and with the advent of lumbering, oil and gas production, and other nondirect subsistence activities, the catchment zones for local populations broadened far beyond the Big Sandy locality itself. While it is possible to inventory resources and procurement strategies to model various mixes (cf. Figure 3.2) for these contemporary groups and their immediate forerunners, comprehending local consumption and procurement of essential resources under the potential catchment approach operationalized here would far exceed the scope of the present project. Therefore, this additional source of information and understanding will not be developed. It remains a fruitful area for future consideration.

PROCUREMENT STRATEGIES

The primary means of securing necessary resources included hunting, fishing, collecting, and gardening. Prehorticultural populations emphasized hunting and collecting. Horticulture was not practiced at all, and fishing, if done, seems to have been of minor importance. On the other hand, horticultural groups engaged in all four strategies to some degree. Extraregional trade does not appear to have been of any consequence to Upper Sabine populations, nonhorticultural or horticultural.

Hunting

Hunting was done by hand- or atlatl-propelled darts during earlier periods and by the bow and arrow during Caddoan times. Absentee capture devices, such as snares, traps, deadfalls, etc., were probably used, but the historic records are disquietingly silent on this point. Hunting was an exclusive male pursuit during historic times (Griffith 1954; Swanton 1942) and is assumed to have been so during earlier times as well. Hunting dogs are mentioned by the chroniclers (Swanton 1942), but, aside from a solitary record of their use in "treeing" bear (Griffith 1954:115), their role in hunting is not clear. Animals were stalked by hunters wearing the skins of the animals they were seeking (Swanton 1942; Griffith). The long-distance buffalo hunts, which were so important to East Texas Caddo during the winter, were probably enabled by the horse and may not have figured prominently in pre-European contact times. These historic buffalo

hunts were communal affairs, but the nongregarious woodland animals were probably hunted with most success by solitary hunters or by small groups (in the case of deer and bear).

Fishing

According to Griffith (1954:113), fish were merely a supplemental food to the Hasinai, and fishing was a short term communal activity done during the period of summer low water. Based on available evidence, fishing was not an important activity of prehorticultural folks in East Texas; five bones, possibly from a single individual, recovered from Archaic levels at the Miller site (Johnson 1962:Table 5) constitute the sum total of fish remains in pre-Caddoan sites. T[illegible]s is certainly not overwhelming evidence for the importance of fishi[illegible] in prehorticultural subsistence strategies. The reader need har[illegible] be reminded that the minor role ascribed to fishing by historic a[illegible] archeological evidences may be a problem of data recovery and obser[illegible]nal timing, rather than a real economic neglect of this omniprese[illegible]source.

Though the actual acquisition of fish by large family or multiple family groups may have been confined to short spans during the summer, fish would have been available over more extended periods. Surpluses from the summer fishing trips were smoke-dried and stored. LaHarpe, for example, who visited the Kadohadacho in early April of 1719 was feasted with smoke-dried fish (Swanton 1942:57), no doubt left over from the previous year's larder. Although there is no direct evidence from East Texas, the use of unmanned fishing facilities, such as nets, traps, trot-lines, could have provided fresh fish during most seasons with a minimum amount of effort and with little labor tie-up.

Collecting

Food collecting could have been implemented without the aid of sophisticated tools and aids. Flexible containers would have been the principal technological facilities needed to hold and transport most collectibles. Food collecting seems to have been woman's work among the Hasinai (cf. Griffith 1954:121), and the same probably held for earlier periods. Children could have aided immeasurably in these repetitive tasks.

Practically all of the wild plant foods are seasonally available, and the scheduling of exploitation would have had to have been very precise, particularly with respect to the "perishables", such as fruits and herbs. Nuts, acorns, and seeds are available for longer periods and do not "ruin" as quickly as other foods because of their hard outer casings. Yet they too would have had to have been gathered rather quickly upon ripening because of the intense competition from wildlife. Rendering flour and drying would have also prolonged the availability of many of these plant foods.

Horticulture

While all of the above procurement strategies were employed by East Texas native populations, plant husbandry was exclusive to the late prehistoric and historic periods. When it became an integral facet of native economies is unknown, but it is suspected to have been become important only after A.D. 700-800 and perhaps even later, coinciding closely with the emergence of the Caddoan tradition. Its importance in year-round food provision, even after if was thoroughly integrated, has often been overplayed. There can be little doubt that plant husbandry did become, especially by late prehistoric and historic times (say, A.D. 1100-1800), a major economic pursuit around which most other food procurement strategies were scheduled. One should be reminded, however, that farming, like other procurement activities, was a seasonal endeavor (spring to late summer) and even at its height was simply a part of the annual schedule of food provision. Maize was one of the major staples stored to combat the winter lean times by the Hasinai, but, except for the "seed" corn, supplies of this consumable were normally exhausted by winter's end (cf. Griffith 1954).

The major crops grown by the prehistoric and historic Caddo were maize (at least two varieites), beans (several varieties), pumpkins, sunflowers, gourds, and tobacco. After the arrival of Europeans, various nonnative fruits were cultivated (Table 4.5). The plants grown by the Caddo seem to represent the very latest, Native American horticultural aggregate. There are no data to suggest that these plants were assimilated at different times into the horticultural complex, unless the lack of cultigens other than maize at the Alto focus, George C. Davis site, is taken as a real, rather than recovery, phenomenon.

This author can find no evidence, archeological or ethnological, that slash and burn techniques were practiced, and perhaps the oft-recorded mention that the Hasinai sought small clearings for their residential sites (Griffith 1954:59) should be accorded especial economic significance. The Joutel reference to burning the prairies (Margry 1875-1886:345-346, cited by Swanton 1942:127) seems not to pertain to land clearing. Whatever the means of rendering the ground suitable for planting, the Hasinai, for which the best records exist, then followed a strict program of tilling, sowing, and harvesting which involved all able-bodied adults in differing capacities at various times and which was thoroughly integrated with community social and ceremonial functions and imbrued with politico-religious overtones (cf. Swanton 1942:127-133).

Each family seems to have maintained an individual garden. Gardens were cleared and tilled sequentially beginning with that of the Grand Xinesi and continuing through those of the Caddices and other officials to those of the villagers. Clearing of the undergrowth and groundbreaking were communal functions; no one, except the Grand Xinesi himself, pregnant women, and the family for whom the

field was being prepared, were exempted from this work (Griffith 1954: 109). A strict labor organization was maintained, and task-masters insured that everyone maintained a high level of industriousness; laziness was not tolerated.

Only a few hours of work by such large groups was necessary to render the plots ready for sowing. Ground was broken one hand-span deep by fire-hardened walnut hoes, bison shoulder blades, and deer jaws (Griffith 1954:109), and subsequently with European-introduced metal tools. After tilling, it seems that the actual planting and all subsequent work in the gardens, including harvesting, was in the hands of the women.

Gardens were first planted in late April after the end of the rainy season (Espinosa and Morfi, quoted in Swanton 1942:129-130). The early maize, called the "little corn", was harvested about a month later and was much relished because it provided the first respite from stored foods. Fields were immediately replanted with the larger flour corn, or "big seed", and this second crop ripened in mid-summer. Both maize harvests were times of feasting and much ceremonial ado. The other garden crops were picked as needed after ripening and seem not to have been as ceremonially significant as corn.

Summary

These four food procurement strategies dominated East Texas economies, principally of the native groups, until economies were remodeled under nonfood media of exchange mechanisms during the nineteenth century. How these strategies were integrated, scheduled, and relatively weighted by East Texas folks is the primary topic considered in the following section.

PROCUREMENT STRATEGY MIX MODELS

As a further step in the empirical process of defining and delimiting potential catchment zones in the Big Sandy drainage basin, this section will set forth available data, arguments, and speculations regarding resource use and procurement strategies. The purpose here is to disclose the kinds and amounts of resources used and the details of the means of acquiring these resources in an effort to model economic systems. By demonstrating how and in what proportions resources were used and labors were expended, it becomes possible to postulate the composition and requirements necessary for any particular section of land to have furnished a suitable, favorable area, capable of supporting an economy of any given type. When joined with the natural potentiality of the Big Sandy locality, it is possible (theoretically) to define and practically delimit certain sections of the Big Sandy floodplain and flanking hills in terms of their relative value as potential catchments and noncatchments.

At this stage in constructing empirical catchment models, it is necessary to distinguish nonhorticultural from horticultural economies. As previously intimated, only one procurement strategy--plant husbandry--is not common to both broad economic divisions, but that singular strategy, almost regardless of the quantity of foods it produced, was so important to human adaptation that it influenced practically every other system of resource provision and, most importantly for practical purposes of this reconnaissance, the distribution of populations over the landscape. In other words, if we could list the entirety of foods consumed by East Texas natives, we would not find extreme differences between horticultural and nonhorticultural populations. If we could quantify to the nearest kilogram the exact value of wild vis-a-vis domesticated foods to horticultural and nonhorticultural populations, it is doubtful that extreme disparaties would be apparent. But systems of land tenure, usage, and settlement of the opposing economic divisions are expected to be quite distinctive, because the requirements and demands of horticulture were far more limiting, given the then available technology, than those associated with strictly wild plant and animal exploitation.

With this important consideration in mind, nonhorticultural (prehorticultural) facts and fictional possibilities will be separated from horticultural details.

Prehorticultural Strategy Mixes

As previously mentioned, subsistence data from the general Big Sandy vicinity are available for only three sites, e.g., Yarborough and Miller (Johnson 1962) and Resch (Webb et al. 1969). The Yarborough and Resch information is devoid of quantitative meaning. At Yarborough the only animal remains collected were artifacts of deer antler and bone, nonartifactual remains were evidently not saved. At Resch, preservation conditions were less than optimal resulting in the recovery of only 45 bone fragments. Of these, only deer and an unspecified species of bird were identified (Webb et al. 1969:73). Plant remains from Resch (Webb et al. 1969, cf. Table 4.4) were limited to nut and acorn hulls preserved through charring. Small scale recovery techniques were not deployed at either Resch or Yarborough. They were not used at the Miller site either, but at Miller we have the only quantifiable information on Archaic hunting strategies. The lack of water screening and flotation at Miller recommends caution in making too much of this corpus of subsistence data, but since no other data are available, they will furnish the basis for reconstructing Archaic hunting strategies in the area.

The faunal remains salvaged at Miller totaled 1008 fragments. Even though sample reliability is not beyond question, Curtis Tunnell did identify and calculate the minimum number of individuals (MNI) represented in the collection, and his breakdown is the sole source of quantitative information on LaHarpe Aspect hunting patterns in

East Texas (Johnson 1962:Table 5). Tunnell recorded a total of 227 individuals from Miller but since his methods of arriving at this figure were not disclosed, this author has taken the liberty of extrapolating totals from Tunnell's list (cf. Johnson 1962:Table 5) by counting mandibles of mammals and utilizing Tunnell's figures for all other classes of animals (i.e., turtles, fish, and birds [turkeys]). These revised totals are presented in Table 4.6.

Using White's (1952:Table 14) estimates of usable meat, it may be determined that deer, raccoon, and birds, probably turkeys, were by far the most important sources of meat; deer alone providing 88.24 percent of the total quantity (Table 4.6).

TABLE 4.6. Usable Meat Breakdown at the Miller Site

Species	MNI	%	Usable Meat Per Animal	Total Usable Meat	Percentage
Deer	22	32.3	100.0 lbs	2200 lbs	88.24
Raccoon	10	14.7	17.5 lbs	175 lbs	7.02
Turkey	8	11.8	8.5 lbs	68 lbs	2.73
Cottontail-Hare	9	13.2	1.75 lbs	15.75 lbs	.63
Terrapene	10	14.7	1.0 lb (?)	10 lbs	.40
Skunk	2	2.9	5.0 lbs	10.0 lbs	.40
Opossum	1	1.5	8.5 lbs	8.5 lbs	.34
Mustela (Mink?)	5	7.4	1.0 lb	5.0 lbs	.20
Fish	1	1.5	1.0 lb (?)	1.0 lb	.04
TOTALS	68	100.0		2493.25 lbs	100.00

It it is presumed that optimal habitat conditions uniformly existed within a 2.5km radius circle around the site (which they obviously did not) and that carrying capacities for the various exploitated species (excluding *Terrapene* and skunk for which no population density figures are available and also eliminating fish for which published biomass figures of 988 to 1483 pounds [450-674kg] per hectare would suppress all other numbers into insignificance) were as given in Table 4.3, it is quite evident that highly selected hunting was practiced by Archaic folks at the Miller site. Tables 4.6 - 4.7 provide a basis for comparing carrying capacity and biomass within a circumscribed 2.5km radius catchment zone centered on the Miller site with the animals actually exploitated.

TABLE 4.7. Animal Population Densities and Total Estimated Number of Individuals Within 2.5km Radius Circle Surrounding Miller

Species	Est. Density	Total Animals	Percentage
Deer	1/4.05ha-1/6.07ha	483-323	16.59-11.74
Raccoon	1/4.05ha	483	16.59-17.55
Turkey	1/54.2ha	36	1.24- 1.31
Cottontail-hare	1/1.21ha	1620	55.63-58.87
Terrapene	?	?	? ?
Opossum	1/8.09ha	242	8.31- 8.79
Skunk	?	?	? ?
Mustela-Ferret	1/40.47ha	48	1.65- 1.74
	TOTALS	2912-2752	100.01-100.00

Comparison of Tables 4.6 and 4.7 shows that deer, turkey, *Mustela*, and Ferret were exploited in numbers far greater than their relative densities. Raccoons were taken in numbers that approximated their densities, and all other animals were exploited well below carrying capacities.

There is another important meaning in the Miller animal food procurement mix. Hunting emphasis was centered on upland game. Although the site was physically located on a rise in the Sulphur River floodplain and thus was immediately surrounded by semi-aquatic and aquatic habitats, there are precious few indications that the bountiful floodplain faunal resources were exploited. The probable single fish in the Miller inventory is not strong evidence for fishing. Floodplain environments, similar to those at Miller, have produced biomass estimates of 450-674kg per hectare (U.S. Army Corps of Engineers 1976b). In addition, freshwater mussels were decidedly underrepresented; only one shell, and it converted into an artifact, was identified (Johnson 1962:262). Other bottomland and water-loving mammals (e.g., gray squirrel, otter, beaver, swamp rabbit, etc.), reptiles, and resident and migratory waterfowl are conspicuously missing in the faunal inventory from Miller. Despite its location within the floodplain proper, Miller site hunters definitely seem to have centered their activities in the flanking uplands for game resources.

Although all of the game animals in the Miller faunal inventory were residents and therefore would have been available year-round, there are certain accessibility factors, geared primarily to behavioral habits, that suggest seasonal exploitation.

Antlered deer at the Miller site indicate kills between October and early January. No aging studies of the pattern of tooth eruption and wear have been done to see if deer were also taken at other times of the year. Nonetheless, fall and winter are the seasons when deer concentrate in the mast-producing woods to take advantage of the acorns and nuts. Evidences of feeding habits are quite easy to detect at this time. The loss of foliage in the deciduous woods would have increased the likelihood of sightings, and trails used by these animals become easier to locate in the fallen leaves. Location by sound is also enhanced during the seasons when leaves are on the ground. "Hooked" bushes furnish highly visible signs of deer presence, and their distribution provides for recognition of patterns of movement. Scrapes--small areas cleared of ground cover--become central points during the rut, which reaches its zenith during the winter. Coupled with the less cautious behavior brought on during the rut frenzy, hunting efforts concentrated during the rut would have had the greatest chances of success of all the periods during the year.

Raccoons also breed in December and January (Lowery 1974:418) and perhaps would have been most visible and accessible during this time. There is a definite dirunal bias to their activities; they are primarily active during the late afternoon and night, resting and sunning themselves in trees during the day. During summer, hot weather, raccoons are infested with "wolves", fly-larvae which make leathery encrustations in the skin, and other parasites, making them less desirable foods during this period. Their nocturnal habits suggest that absentee capture systems might have been the most appropriate means of acquiring these animals, a possibility which further seems to be borne out by the fact that Miller site inhabitants exploitated raccoons in numbers about equal to their population densities (cf. Tables 4.6-4.7).

Turkey, on the other hand, are most susceptible to hunting during the spring breeding season (April and May). Sexual demonstrations by the gobblers during this time make them easier to locate and amenable to "calling". They cannot be attracted by mimicking the enticing call of the hen at other seasons. Although foliage is dense in the spring, turkey do tend to move into the openings and clearings during this period to engage in courtship and mating, as well as to take advantage of the ripening nettle and grass seeds and insects. Tracks and "dusting areas" make it relatively easy to pinpoint the birds' activities. Known today as the wiliest of game birds, turkey may have been far less cautious in times past if stories about treeing with dogs and dispatching the birds with long, hand-held poles have any merit (Swanton 1911).

The other animals hunted by Archaic peoples at Miller have their own particular behavioral patterns, habitats, and ranges, which would have made them more susceptible at certain times and places than others. However, since these species did not figure prominently in Miller diets, it may be doubted that hunting efforts were geared to any significant degree to the habits of these animals. They can almost be considered as lagniappe (something extra), taken incidentally while hunting deer, raccoon, or turkey.

No plant remains were recovered from Miller, and, in fact, the only vegetable foods known for the general area derive from the Resch site (Webb et al. 1969), where attribution to exclusive Archaic, or prehorticultural, contexts is actually not positive. It goes without saying that the hickory, black walnut, and pignut hulls recovered by dry screening methods at Resch are probably not representative of the entire spectrum of plant foods collected by Archaic populations at that site alone, much less throughout the general Upper Sabine region. Nowhere have small scale recovery methods been used in appropriate contexts to date, and supplemental methods of extracting floral use information--pollen analysis, phytolith identification, human bone constituent analysis--have not been tried.

Webb et al. (1969:73) did not distinguish the proportions of the various nuts at Resch, thus making it impossible to elucidate their relative importance. Since the hickory species were not specified, determining habitats is also difficult. Hickories, pignuts (also a hickory), and black walnuts are widely distributed and occur in a variety of habitats in East Texas. Black walnuts are not abundant anywhere (Brown 1945:40), but hickories and pignuts are common and occasionally form thick stands on sandy slopes, ridges, and higher flats in the uplands which are immune to flooding. In such areas, intensive harvesting could have transpired.

Hickories are sporatic mast-producers, good years are often followed by one or more bad years. However, there seems to be little uniformity in the level of overall productivity. In other words, a bad year for one stand of trees may be a good year for another stand some distance away (cf. Ford 1979:236). In good years, hickories are prolific mast-producers; a bushel per tree per year is a conservative estimate (cf. Munson et al. 1971:414). In addition, they are a valuable source of protein and oils and have very high caloric values (i.e., hickories, 603-811 cal/100g Burns and Viers 1973:Table 2 ; black walnut, 628 cal/100g; U. S. Department of Agriculture 1964). Complications arise, however, when trying to calculate the total nut productivity of a given locality because the real measure of the quantity of nuts available to human consumers is net productivity (Odum 1971), the amount of mast remaining after other animal species have taken their share. Such interspecific competition is no small matter, especially after nuts have fallen to the ground and become available to terrestrial, as well as aboreal, feeders.

Simple interpretations of the role of nuts in Archaic diets and in procurement scheduling strategies must be avoided. There has been a decided tendency to overplay the seasonal availability of these foods. This has often led to pronouncements about fall-winter occupations and subsequent site abandonment. It is true that nuts are available only during the fall and early winter, but their hard, outer casings would have rendered storage quite facile, extending their availability for consumption well into the spring and possibly the summer. Hence folks engaged in nut harvesting would not necessarily have had to shift settlement locations during the ensuing spring. In this regard, Griffin (1979:278) has recommended an appropriate line of inquiry.

Though concerned with Hopewellian subsistence bases and settlement patterns, it applies equally well to any cultural group who made use of the abundant wild nuts; thus Griffin (1979:278): "Someone ought to investigate where many of these populations hibernated because they seem to have operated only in the spring, summer, and fall". Actually Griffin's suggestion may be restricted even further with regard to East Texas prehorticultural groups. They seem to have existed only during the fall and early winter, disappearing with the falling leaves and mysteriously reappearing the next year with the turning of the leaves. Such logical extremism is obviously an overstatement, but the fact remains that preservation posibilities and typical recovery methods favor the collection of nut remains, not other, softer plants which must have figured prominently during their own seasons in the diets of East Texas Archaic and Pre-Caddoan residents.

In spite of the limited and obviously biased information on prehorticultural subsistence in the Upper Sabine Valley of East Texas, it is possible to draw several conclusions. There is a pronounced upland orientation to the animal foods utilized at the Miller site. The prominant semi-aquatic and aquatic animals of the floodplain, particularly the fishes, migratory waterfowl, mussels, turtles, and aquatic mammals do not seem to have been exploitated despite the site's location in the Sabine floodplain. While the ranges of deer, raccoon, and Mustela do extend throughout the wetlands, they also embrace the floodplain margins and the uplands. Coupled with the other exploitated animals, whose habitats are more restricted to elevanted terrain, it is logical to conclude that hunting and trapping (?) activities were concentrated in the flanking uplands and upland edges. The plant remains from Resch also have a decided upland flavor.

The upland orientation of nonhorticultural subsistence seems assured. However, the available nonhorticultural subsistence data from the Upper Sabine region simply will not bear quantitative division of foods in terms of the amounts (absolute importance) contributed by each and every wild food species exploitated. The inability to quantify food sources directly from archeological data is a serious problem which can only be overcome by remedial recovery efforts in the region. In the absence of data, a different approach to quantification has been followed. From studies of other hunting and collecting societies, Earle (1980:20) has generalized that hunting provided around 60 percent and collecting about 40 percent of the foods eaten. This 60-40 proportional mix has been used as a rough standard for gauging a hypothetical mix combination produced simply regarding the species or groups of species hunted and collected by East Texas Archaic and Pre-Caddoan folks as an individual procurative activity, with the sum of the activities being used as the basis for calculating the percentage mixture of the major activity classes, i.e., hunting and collecting.

No attempt will be made to justify or specifically support this means of quantifying procurement strategy mixes. It will only be suggested, as a future line of possibly meaningful inquiry, that procurement activities associated with individual species or groups of species whose behavior or nature/character submitted to a common exploitative

strategy probably have a direct relationship-correlation with food quantities and proportions. The relationship is expected to be linear, though not necessarily perfect because of cultural or even whimsical food preferences, taboos, or other reasons. At present, it will only be assumed that the percentages of individual procurement activities will reflect, in at least a general way, the percentages of various foods available. The following proportional breakdown, using the unsophisticated procedure described above, takes on credibility because it is not that different from Earle's (1980) generalization. Summarily, the procurement strategy mix of native, nonhorticultural, East Texas societies may be quantified thusly: hunting (eight activities), 67 percent; and collecting (four activities, 33 percent.

Horticultural Strategy Mix

There is absolutely no firm data on which to quantify the absolute or relative values of the various wild and cultivated foods which comprised the diets of East Texas Caddo Indians. The Hasinai food and resource use information, to which this discussion is limited, is far more extensive, qualitatively, than the archeological information available from the Miller and Resch sites, which furnished the basis for calculating the nonhorticultural procurement strategy mix. Yet there is not one shred of solid information, historical or archeological, which would permit quantification of the food resource base. There are hints of relative importance of various food sources in ethnohistorical admissions that some foods were used only in lean times and that others were exploitated only periodically (e.g., fish, bison, etc.) (Swanton 1946; Griffith 1954).

As a consequence of this lack of information, an hypothetical breakdown of Hasinai procurement strategy mix has been calculated via the procedure used above (cf. total number of hunting, collecting, fishing, and horticultural activities divided by combined total of all activities). From Table 4.5, the number of species of species groups which furnished the foci of procurative activities can be determined as follows: hunting, 12 activities; collecting, 12 activities; fishing, one activity; and horticultural-animal husbandry, 18 activities, for a sum total of 43 separable food procuring or producing operations, or tasks. By figuring simple percentages, the following procurement strategy mix can be derived: hunting, 27.9 percent, collecting, 27.9 percent; fishing, 2.3 percent; and horticulture-animal husbandy, 41.9 percent. Lacking an empirical means of corroboration, it may be somewhat reassuring to compare the derived Hasinai procurement mix with a general horticultural pattern revealed by Earle (1980:20), a pattern having a mix of 24 percent hunting, 32 percent collecting, and 44 percent horticulture.

CORRELATING ENVIRONMENTAL AND CULTURAL DATA

The problem guiding the empirical approach to site survey adopted here was quite simple: using environmental qualities and natural resources of known or suspected importance to human populations having differing economic strategies, find those on-the-ground areas most likely to yield evidences of use by those particular groups (cf. Figure 3.2). The seeming simplicity of this approach is deceptive. The process of selecting on-the-ground areas which seem to best fit empirically those conceptual catchment models, i.e., horticultural vis-a-vis nonhorticultural, has been an involved one, complicated by uneven data.

The substantive data on which the two catchment models have been constructed have been presented earlier. The step-by-step procedure and methods used to transform these data into mappable entities and to circumscribe them on project area maps are set forth below in order to permit replication and methodological refinement.

Determining Economic Value of Various Environments in the Big Sandy Drainage

Presented in Table 4.8 is an evaluation of the economic potential of the three major environments, or biocenoses, in the Big Sandy drainage. It is a crude measure of potentiality, but one compatible with the quantity and quality of data of which it has been constructed. Because of the problem of data unevenness, it has not been possible to arrive at a scale (interval or ratio) where the numbers representing the derived values have real arithmetic meaning. In other words, the calculated value of 554 does not mean that the transition zone is nearly twice as valuable to human economies as the uplands which are represented by a figure of 309 (Table 4.8). Rather the values (309, 554, and 384) simply permit one to place the three major biocenoses in a rank order with the transition zone exhibiting the highest economic potential and the uplands, the lowest.

As is readily apparent, Table 4.8 is made up entirely of wild plants. The decision to restrict the evaluation to wild plants was a practical one. Faunal data, particularly carrying capacities by habitat type, were simply not available. However, as a general rule the more productive the environment in terms of plant foods (whether consumed or consumable by humans or other animals), the higher the faunal carrying capacity. Thus plant food potential is to a large degree reflective of food potential in general. But what does wild plant potential have to do with economies geared to horticulture (i.e., horticultural catchments)? As noted previously, late prehistoric and historic Caddoan economies in the region, as well as the ensuing rural Upland South Anglo economy, integrated wild plant foods with cultigens in considerable proportions. Catchments with a high wild plant food potential should

TABLE 4.8. Food Potential of the Big Sandy Environments

Food Classes by Environment	Ranking Factors						Index
	Species	Cal. Value	Cal. Rank	Avail.	Pro. Dif.	Pre. Dif.	
UPLAND:							
Acorns	12	494	5	6.5	.50	.50	98
Nuts	6	782	8	6	.75	.50	108
Seeds	7	ND	1	4	.75	.75	16
Roots	6	ND	1	4.5	.50	.75	10
Fruits	14	58	1	4.5	1.00	1.00	63
Other	2	21	1	7	1.00	1.00	14
				UPLAND RATING INDEX			309
TRANSITION:							
Acorns	9	425	5	6.5	.50	.50	73
Nuts	8	732	8	6	.75	.50	144
Seeds	21	ND	1	4	.75	.75	47
Roots	20	ND	1	4.5	.50	.75	34
Fruits	21	76	1	4.5	1.00	1.00	95
Other	23	39	1	7	1.00	1.00	161
				TRANSITION RATING INDEX			554
BOTTOMLAND:							
Acorns	5	516	6	6.5	.50	.50	49
Nuts	6	697	7	6	.75	.50	95
Seeds	8	ND	1	4	.75	.75	18
Roots	13	ND	1	4.5	.50	.75	22
Fruits	35	64	1	4.5	1.00	1.00	158
Other	6	36	1	7	1.00	1.00	42
				BOTTOMLAND RATING INDEX			384

be amenable to supporting both horticultural and nonhorticultural economic strategies. Other environmental qualities and factors are judged to be more useful in separating potential horticultural from nonhorticultural catchments.

Table 4.8 contains six columns of factors which are deemed essential to rating the economic potential of the three major biocenoses. These factors include numbers of species (a crude measure of diversity), averaged and ranked caloric values of various plant categories, figures specifying an order for ease or difficulty of procurement, a rank order for preparation difficulty (i.e., ease or difficulty of rendering raw plants into consumable food), and an availability factor comprised of the number of months a class of food plants would be available in a natural and stored condition.

The "species" column simply lists the number of edible species found in each environment (cf. Table 4.1). The next column, labeled "Cal. Value", listed the averaged caloric value (per 100g) of edible plants within each food class. To simplify calculations, the figures in the "Cal. Value" column were transformed to single digits by rounding off; the results are given in the third column, "Cal. Rank". Though some precision is lost, interval level data are still retained. Column four, "Avail.", lists the number of months the plant category would have been available for human consumption. Availability in "raw", or "natural" states and in stored, or preserved, conditions are added together to derive this set of factors. The resultant scale is interval level.

The final two columns of factors in Table 4.8 are scales pertaining to procuration difficulty (Pro. Dif.) and preparation difficulty (Pre. Dif.). The value of a particular plant as a reliable food is related as much to how hard it is to acquire and prepare as it is to nutritional value. Thus these two factors are considered essential to deriving a final index of plant food value as a means of rating the economic value of particular environments. Both scales are rather arbitrary and argumentative and are simply asserted at this time without describing the data and reasoning on which they are based.

The scale of procuration difficulty is broken down as follows. Food plants which could be collected with relative ease and without sophisticated tools, devices, and involved strategies were given an arbitrary rating of one. Various fruits and "greens" have been rated in this category. Plants whose acquisition required extensive investments of labor, time, or skill were rated with scores of .75 or .50, depending on the degree of difficulty. For example, nuts, such as black walnuts or sweet pecans are assigned a rating of .75, while acorns are given a factor of .50. How are these differential ratings justified? Both nuts and acorns can simply be hand-gathered from the ground after seedfall and do not require sophisticated equipment or skill. The rating difference in this particular case is simply due to the fact that the acorns are much smaller than nuts and consequently more effort would have been necessary to collect an equal amount; hence nuts are "easier" to collect.

The same sort of reasoning was used to ascribe a difficulty rating to preparation. Foods which could be eaten raw or with very little preparation, such as fruits, were assigned a one, which means they were the least difficult to prepare. Moderately difficult preparation was given a .75, and the most difficult to prepare foods were assigned a .50.

By multiplying the values and factors given in each of the columns (except "Cal. Value"), an index number is produced for each category of food; i.e., acorns, nuts, seeds, roots, fruits, and other. These indices not only provide a measure of productivity and availability, albeit crude and somewhat indirect, but they incorporate a degree of procuration and preparation difficulty.

Summing the indices for each food category within each of the major environments, or biocenoses, provides numbers which permit the environments to be compared and ranked in terms of their economic potentialities for yielding wild plant foods and, by extension, for providing many other qualities more or less attractive to settlers.

Before dispensing with the mechanics of how Big Sandy environments were ranked, it might be well to point out some items which were not taken into account but which could have had some influence on specific groups (sites or site clusters) at certain times and places.

1. The factor of dominance has not entered into these calculations. For the Big Sandy drainage, these essential data were simply unavailable. However, by not using dominance factors, this exercise has avoided, to some degree, the omnipresent problem in most catchment studies, that of using a specific contemporary environment as the setting for the one utilized at the time of occupation. Since the end of the Pleistocene, food chains, tropic levels and webs, and habitats that characterize present-day ecosystems have been in existence. However, locality- and region-specific changes (geomorphically and climatically) have caused considerable shifting of such ecosystems and a veritable constant panorama of seral stages (succession) in any given spot. By limiting evaluation of biocenose productivity to the rather stable mixture of floral components that constitute the ecosystem per se rather than to any given spot on the ground, we have hopefully provided a general model of broad applicability.

2. This evaluation has not taken into account vitamin, mineral, and trace element compositions of foods which, though certainly not overtly appreciated by Indians or early settlers, might have helped determine utilization by acquired "folk" wisdom.

3. This scheme has not attempted to modify biocenoses ratings further by considering cultural values afixed to certain foods. Food taboos, for example, could have amplified, restricted, or eliminated utilization of potential foodstuffs. Since taste is to a large degree culturally determined, this phenomenon could also have played

a role in choice of foods. Ritual activity, involving food, is another potential source of influence on subsistence economy, and it has not been considered herein.

Because of the multitude of possible influential factors which have not been considered in this exercise, it will again be emphasized that all the present scheme has attempted to do has been to rank the three major environments in the Big Sandy drainage in terms of food potential. The indices (cf. Table 4.8) have no real power to say that one environment has 10, 50, 200, or any percent more food potential than any other. The indices simply reveal that under the rating scheme used here, the transitional environment has the greatest food potential and is followed in order by the bottomland and then the upland.

Mapping Economic Value

Once the three major biocenoses were ranked in terms of wild food potential, it was necessary to transfer this information to project maps. In this fashion, relative natural productivity came to be identified with physical places and thus was made amenable to on-the-ground sampling.

Two primary criteria were used to map relative economic value: soil distributions and animal habitat evaluations. Of the two counties covered by the project area, only Wood County had been subjected to a soil survey (Wood County Program Building Committee 1963:49-53) and that was done before the Seventh Approximation system for identifying soils was adopted. Additionally the map which accompanied the report was small scale and relatively useless for fine-scale planning. Fortunately, a pedological survey of Hopkins and Rains counties, which border the project area to the north and west, was available (Lane 1977). It was possible to extend soil distributions into the project area from these two counties. Soils were judged to be a useful means of mapping productivity because they embody, determine, and/or show so many of the environmental variables, e.g., elevation, slope, vegetation cover, water coverage, etc., that make up natural productivity.

In addition, the U. S. Fish and Wildlife Service provided photocopies of habitat maps of the Big Sandy project area (courtesy of Jerome L. Johnson, Fort Worth). This detailed mapping was accomplished by producing milar overlays of color infrared aerial photographs and transferring to USGS, one to 24,000 quadrangle maps. The results were ground-truthed, and according to Johnson (personal communication, 6 January 1981), habitat areas of at least 10 acres (4.05ha) in size were included.

Since the distributions of soils and habitats coincided to a large extent, i.e., sufficient to recognize the three major biocenoses (uplands, bottoms, and transition, or intermediate, zones), the precise habitat maps provided by the Fish and Wildlife Service were used to derive the figures shown in Table 4.9.

Other Environmental Factors Relevant to Mapping and Distinguishing Catchment Types

The mapping, described above, covered the entirety of the Big Sandy project area. Other variables were used, in conjunction, to pinpoint the locations of potential catchments and to discriminate between horticultural and nonhorticultural areas. These variables include arable soil, presence of floodplain segment, and amount and strength of environmental edges, and a number of factors used to center potential catchments.

1. Arable Soil. Arable soils obviously play a significant role in supporting farming, or gardening, and other interrelated activities. Farmers would thus tend to live and work in areas having friable, arable soils. Nonfarmers have no need for such lands and consequently may have lived and worked in zones lacking good tillable soils. This is not to say, however, that there will be no overlap, or perhaps even a direct, one-to-one correlation between arable soils and archeological patterns produced by both farmers and nonfarmers. This possible correspondence is due to other qualities of arable soils besides simple fertility and ease of filling. Trafficability, flood-freedom, air drainage patterns, and a host of other desirable factors are often associated with places having arable soil and are often directly related to the soil itself. Thus we do not expect to find a nice, neat separation of prehorticultural and horticultural residues based on distributions of arable soils, but there can be no doubt about the strength of influence of this variable on economy and settlement.

The distribution of arable soils and determinations of their proportional representations within potential catchments was based on soil data (Lane 1977) and habitat maps provided by the U. S. Fish and Wildlife Service (Table 4.9). All areas mapped by the Service as abandoned croplands, croplands, and shrubland were classed as arable soils. While obviously these areas reflect only those spots farmed by contemporary folks, they should provide a gauge sufficient to at least rank circumscribed catchments in terms of horticultural potential (cf. Table 4.10).

2. Floodplain. Presence of floodplain zones is another factor which, in connection with arable soil, is viewed as an important regulator of pre-modern economy. In the absence of data to the contrary, prehorticultural groups and economic patterns in East Texas-West Louisiana show a complete dependence on upland resources. Later, presumably horticultural sites and people have, archeologically and ethnohistorically, revealed consistent, though sometimes relatively small proportionally, use of floodplain resources, primarily fish. The essential sedentism associated with farmers evidently placed a premium on nearby, high yield and constantly replenishing food resources. Fish are probably the singlemost easily exploitated source of animal protein consistently available to full-fledged horticulturists and are maximumly and most opportunistically accessible during

summer low water--the season of lowest gardening activity (other than, of course, winter).

Thus for an area to be considered as a potential horticultural catchment, it had to incorporate some of the Big Sandy floodplain proper and preferably part of Big Sandy Creek itself. The reasons for including the master drainage artery of the watershed, rather than simply any creek and creek bottom are based on arguments found in Odum's (1971) ecological breakdown, biotic potential, and energy flow characteristics of lotic water systems, which are simply much too involved to recapitulate here. It should suffice to say that Big Sandy Creek and its major permanent tributaries within its floodplain have higher fish and other aquatic animal populations than other streams. Because prehorticultural peoples apparently had little use for aquatic resources, potential nonhorticultural catchments were not extended over the Big Sandy floodplain proper.

3. Edge. Based on arguments presented in Chapter 2, the proportional occurrence of environmental edges has been a further consideration in delimiting and classifying catchment zones. The basic premise on which these arguments are predicated is Odum's (1971), so-called "edge effect" or, to wit, tension zones (or areas where distinctive biocenoses are joined) exhibit greater variety and higher density of biota. For peoples whose economy was based on hunting and foraging, edges are presumed to have been of great importance (cf. Chapter 2); for horticultural folks, they are thought to be less consequential.

The relative amount of edge area was used, along with the other variables discussed above, to distinguish potential catchments from noncatchment areas and within potential catchment zones, to separate horticultural from nonhorticultural catchments. In a general sense, sections of terrain having dissected (as opposed to a "smooth") topography were considered as prospective zones for catchments. Those parts of the project area which seemed to have a homogenous or flat or gently domed terrain were tentatively identified as noncatchments, or more precisely, as off-catchment areas. At this point, "recognition" of homogeneous vis-a-vis heterogeneous terrain was purely subjective, based simply on careful visual inspection of quadrangle maps. Once, however, areas were roughly "sorted" into these two types and the other variables that were used to build the substance of potential catchment zones were integrated to determine where catchment areas would be drawn on maps, the actual amount (linear) of edge was measured to serve as a means of separating horticultural from nonhorticultural catchments.

Edges were recognized on USGS quadrangle maps as any area along a water course of any size and areas where "dissected" terrain was revealed by the close spacing of contour lines (close in this instance, meaning five or more contour lines in the space of 1.0cm [i.e., maps of 1:24,000 scale]). Although no absolute limit was set on the amount (i.e., total linear distance) of edge necessary to classify potential catchments as horticultural or nonhorticultural, greater amounts of edge were emphasized in areas proclaimed to be nonhorticultural than in those assigned to an horticultural category.

4. Factors Used to Center Catchments. In addition to being environmental qualities commonly associated with human settlement, the following three factors were used (in conjunction with a fourth consideration) to center the potential catchment zones and to physically transcribe circles on project area maps; the circles representing this investigator's means of identifying catchment constructs on a map so that they can be subjected to on-the-ground examination.

a. Location along Potable Permanent Water. Location at or very near sources of permanent drinking water was a primary criterion for positioning central points of catchment circles. The centers of all economic catchments are in reality residential areas--those spots from which humans in their quest for food and other essential resources rhythmically dispersed and gathered (cf. Roper 1979). Places of residencies must always be located so that drinking water is handy.

b. Flat, or "Slopeless" Surfaces. In addition to being along a permanent, potable water body, the center of any proposed catchment was located at a spot which was relatively flat, or "slopeless". The argument supporting this factor is the common sensical conclusion that places of residence should be located so as to permit the maintenance of gravitational and inner ear equilibrium with the least amount of effort given the technological means available. Flat ground surfaces are the simplest means of satiating this requirement.

c. Stream Confluences. A third factor used in conjunction with the first two (a-b) to govern the placement of catchment centers is stream confluence, or the point where two permanent streams join. The importance of this factor is discussed elsewhere in this chapter.

d. Known Sites. Centers of most catchments were determined empirically upon the co-occurrence of potable water, flat surface, and stream confluence. However, a few of the potential catchments were centered at the locations of previously known sites, and the positioning of these circles sometimes had a domino effect on others placed after them. In other words, a circle drawn around an area having a known site at its center affected, in some cases, the drawing of circles next to it, and in turn, those affected their neighbors, and so on. It should be mentioned that circles around known sites were not used to start the process of delimiting catchments on maps. To have done so would have been to let previously known site locations relieve the present approach to delimiting catchments of its professed empiricism. No, known sites were used as centers when the segment of maps being examined met all the other criteria and conditions for catchments and when the known site lay near the projected center anyway. The adjustments to neighboring catchment circles (the domino effect) occasioned by catchments with known site centers was usually slight and limited to those cases when circumferences overlapped.

Of the eight potential catchments within the project area only catchments 3 and 5 were centered on known sites; catchment 3 (Pine

Mills) at 41WD31 and catchment 5 (Greenbriar Lake) at 41WD57. A third potential catchment (Liberty Church, not numbered), which lay almost entirely outside the project area boundary, had a known site center (41WD22).

Classification of Potential Catchments

Once all the empirical input and centering factors were correlated, circles (potential catchments) were drawn on project maps with a compass. As a parenthetical note, the decision to use circles with 2.5km radii, rather than some other geometric figure or alternative bounding criteria or size, was purely an arbitrary choice. However, by drawing relatively small circles, it was possible to make on-the-ground coverage as extensive as possible while still adhering to the research design and strategy. In addition, it should be recalled that the present investigation constituted an empirical catchment approach, not a catchment analysis *per se*. There was no need or compelling desire to make the potential catchments derived here match or approximate real site-specific catchments. It was presumed if the catchment constructs themselves were sound and most settlement-deterministic criteria were included, that even 2.5km radius circles should incorporate, or *predict*, archeological sites.

Eleven potential catchments were superimposed on project area maps. Eight of these areas fell wholly within the boundaries of the study area; the other three were largely outside it and consequently were eliminated from further consideration.

Table 4.9 shows percentages of habitat, or biocenoses, and arable soils in each catchment. This provides the empirical stuff on which classification decisions were initiated.

TABLE 4.9 Biocenose and Arable Soil Percentages within Catchments

Catchment	Biocenoses %			Arable Soil %
	Uplands	Transition	Bottom	
1	49.2	22.5	28.3	16.9
2	81.6	11.4	1.5	17.5
3	67.4	28.0	4.5	19.3
4	47.5	42.8	9.6	16.0
5	75.7	14.7	9.5	16.7
6	43.7	43.3	13.0	18.0
7	23.7	60.6	15.6	35.1
8	8.7	70.2	21.2	24.8

All of the preceeding data and arguments in this chapter may be reduced to the following statement, which furnishes the basis for determining whether a catchment was classified as nonhorticultural or horticultural. The rank order of catchments determined by summing the percentages of bottoms and arable soils (i.e., cropland or fallow habitats on U.S. Fish and Wildlife habitat maps plus areas of transition zone) will yield a range of potential catchments from those best suited for horticulture to those most poorly suited. Table 4.10 presents the empirical results of this operation and the classification of the eight catchments.

TABLE 4.10. Ranking and Classifying the Catchments

Catchment	Percentages			Total	Classification
	Bottoms	Arable	Transition		
1	28.3	16.9	22.5	67.8	?
2	1.5	17.5	11.4	30.4	NH
3	4.5	19.3	28.0	51.8	NH
4	9.6	16.0	42.8	68.4	?
5	9.5	16.7	14.7	4.09	NH
6	13.0	18.0	43.3	74.3	?
7	15.6	35.1	60.6	111.3	H
8	21.1	24.8	70.2	116.1	H

H, horticultural; NH, nonhorticultural.

Obviously the extremes of this scale were easily categorized, but the three catchments whose values are roughly the same and fall around the median could not be assigned with confidence to either category. We hoped to remedy this uncertainty by targeting two of these middle-range catchments for survey. Unfortunately, the uncertainty remains, even after survey.

Thus, two of the eight catchments (nos. 7 and 8) were classified as horticultural, three as nonhorticultural (nos. 2, 3, and 5), and three remained unclassified (nos. 1, 4, and 6).

CONCLUSIONS: THE LOGIC OF SAMPLING

The Big Sandy investigation was restricted by contract to survey only 1280 acres, or 5.18km^2, of the study area. This represented less than one percent (actually 0.78 percent) of the geographic area lying within study boundaries. From the outset, the Big Sandy reconnaissance was only slated to cover a part, and a very small part at that, of the entire area that might be ultimately affected by reservoir

construction. Thus, the Big Sandy reconnaissance was a sampling endeavor, and it was approached from this perspective.

As described previously (Chapter 1 - et passim), the guiding interest of this investigation lay in ascertaining whether or not pre-modern cultural variation (i.e., sites) could be predicted by modeling two major kinds of economic adaptation known to have been adopted in the surrounding pineywoods country of East Texas and West Louisiana. Such a research orientation not only had theoretical, methodological, technical, and substantive value, it fulfilled a major contract requirement by providing a vehicle whereby site variability and numbers recorded in the surveyed sample could be used to extrapolate to the entire study area.

The empirical models developed in this chapter provide sampling parameters, or strata. Thus the parcels of ground surface covered by survey constitute a stratified sample of the study area. However, the strata are defined by cultural-environmental criteria and not merely arbitrary, or geographic, ones (cf. Ragir 1967:188).

By converting the conceptual models (i.e., horticultural and nonhorticultural potential catchment areas) to circles on a map having 2.5km radii, the project area was divided into discrete spatial units that furnished the target areas guiding extraction of the sample fraction (i.e., 0.78 of one percent).

A total of eight potential catchment areas was encircled on project area maps (Figure 4.2). As indicated above, these were divided into two types--horticultural or nonhorticultural. The intervening areas, those sections lying outside the circumscribed catchments, were classed as noncatchment, or off-catchment, areas. Thus sampling strata were constituted of one, a potential catchment vis-a-vis noncatchment division, and two, a horticultural vis-a-vis nonhorticultural subdivision within the catchment stratum. The noncatchment stratum had no corresponding subdivision because conceptually it was supposed to harbor no archeological sites, or rather sites could be present but densities and/or indications of residence or prolonged activities should be fewer than from within catchment areas.

As in all sampling efforts, the major problem in the Big Sandy reconnaissance was how to expand sample size (i.e., the number of observations made), within logistically manageable limits, without expanding the sample fraction (i.e., 0.78 percent)(cf. Plog et al. 1978:395-396). The desire for maximizing sample size, of course, is attendant on the fact that the probability of an inference being accepted or rejected increases as the sample size increases (Plog et al. 1978:395). It would, for example, have been possible to have taken the required sample fraction of 0.78 percent (i.e., 1280 acres, or 5.18km^2) from within one catchment type, say an horticultural catchment. Any one of the catchment circles contains 19.64km^2, so indeed any given potential catchment could have accommodated the entire sample fraction. Yet confining the survey (number of observations) to a single horticultural catchment area would have left unresolved the matter of whether

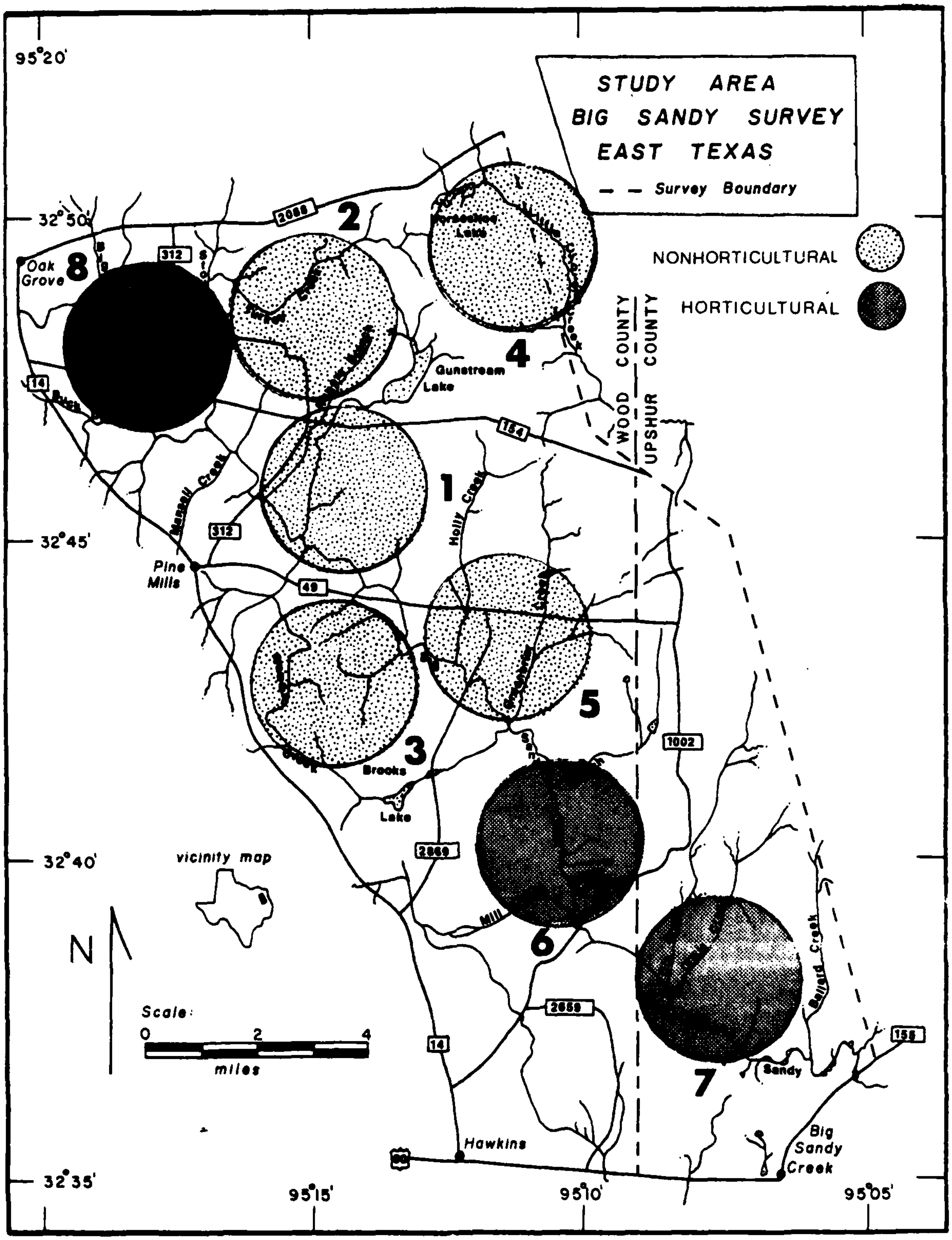


FIGURE 4.2. Potential Catchments in Study Area.

catchments served to predict site locations better than noncatchments, not to mention whether nonhorticultural catchments contained nonhorticultural sites in numbers that belied nonrandomness. In other words, if the Big Sandy survey had been limited to a single parcel of land in a confined section of the study area, it would not have furnished a hypothesis-testing/predicting framework (cf. Chapter 3).

The attempt to strike an effective (cost- and time-efficient) compromise between sample fraction and sample size produced the following survey deployment strategy. Although the range of site size in the Big Sandy drainage was not known prior to survey, it was expected, on the basis of information from immediately surrounding and not-too-distant, environmentally similar areas, that sites, with a few exceptions, would be small, say less than $625m^2$, or 25 by 25m. (It was not anticipated, however, that they would turn out to be as "small" as they did.) Nevertheless, the projected size figures suggested that ground inspection should incorporate a spacing interval, or intensity, sufficient to "discover" such small occurrences. As a consequence, it was decided to use search paths (i.e., transects) 100 feet (about 30m) wide. Transects have proved to be more efficient than quadrats (Plog 1976:151-153). These corridors were to be inspected by two pedestrians, spaced about 50 feet (around 15.0m) apart, or by a single pedestrian walking "in and out" along two independent but parallel lanes. Actually precise spacing was not possible because of the terrain and because spacing was judgemental (visually estimated). As a consequence, transects turned out to be somewhat variable, and the amount of ground surface actually inspected was no doubt somewhat larger than the $5.18km^2$, specified by contract. As a matter of fact, the total linear distance covered during the survey was 106.56 miles (about 171km), adding approximately six more acres (2.4ha) to the sample fraction.

In order to test the predictive powers of the models, it was necessary to run transects across those areas defined as catchments and noncatchments, as well as across horticultural and nonhorticultural catchments. Consequently, half the sample fraction ($2.59km^2$, or about 84 linear kilometers) was to have been taken from catchments, half from outside (noncatchments). Transects within catchments were to have been equally divided between horticultural and nonhorticultural catchments. In actuality, about 52 percent of the sample fraction was taken from noncatchment areas.

Deciding which four of the eight potential catchment areas would be subjected to survey was largely a conceptual matter. The two catchments having the most extreme values (nos. 2 and 8; Table 4.10) were included. These areas were the most divergent within the target population and were logical choices to receive survey transects. The inclusion of potential catchments 1 and 6 was another matter. As shown in Table 4.10, the values of these two areas lay in the middle of the range; in fact, on either side of the median. It was hoped, by targeting these two catchments for survey, that it would be possible to judge the cut-off point on the scale (Table 4.10) between horticultural and nonhorticultural areas. Ideally, the cut off point should

have been between catchments 4 and 1, with catchment 4 falling on the horticultural side of the scale (cf. Table 4.10). However, there was no way of knowing this _a priori_ because the rank order of catchments in Table 4.10 was simply an expression of horticultural potentiality, with the sections having the highest values rated better for gardening than those in the lower values. The scale was relative, not absolute. It was conceivable that all of the catchments included in Table 4.10 could have supported horticultural activities. The arguments marshalled in the preceding pages suggest that the opposite ends of the scale should have horticultural _vis-a-vis_ nonhorticultural meaning, and sampling of the two catchments juxtapositioned around the median was proposed as a means of deciding. There was also practical reason, or support if you will, for the selection of these four potential catchments. Catchments 3 and 5 contained known sites, and thus were automatically excluded from the sample.

Thus of the four potential catchment areas surveyed, two were judged to be horticultural (nos. 6 and 8) and two, nonhorticultural (nos. 1 and 2). It should be recalled that the encircled, potential catchment areas covered 19.64km^2. The equal apportionment of transects among the four catchment areas meant that each catchment would receive transects, totaling 21km in length and covering an area of 0.65km^2. In other words, even within those potential catchments targeted for survey, actual on-the-ground coverage amounted to only 3.3 percent of the territory circumscribed by any catchment circle. Thus the sample fraction within any one catchment was very low, but it was hoped that the combination of a stratified sampling strategy and the deployment of transects (both proven to give better results than other sampling programs, cf. Plog 1976; Plog _et al_. 1978) would produce a sample _size_ sufficient to minimize the effects of the tiny sample fraction.

The precise pattern of transects within catchment areas was not dictated by theory or conceptual models, other than by the simple belief that sites, particularly residential ones, would lie near streams, would repose on flat surfaces, and would probably be near stream confluences and environmental edges. Thus transects were surveyed where logistics and access conditions permitted maximum exposure, or ground contact, with this combination of factors. Because the pattern of transects within catchments typically formed enclosures (that is to say, survey routes usually started and ended at the same point), coverage was efficient and cost-effective but at the same time it produced a sample size practically coincident with the sample fraction. In other words, the transects within catchments were usually confined to limited sections and were not widely dispersed throughout the encircled territory, where other spots bearing the requisite combination of features usually associated with residential sites occurred. The problem, of course, related to this sampling procedure is that if factors besides the ones anticipated to co-occur with residences were also influential in site locations (as they no doubt were), then the confinement of survey transects to one limited segment might not produce a representative picture of site distribution within the

entire catchment. While this problem is recognized as a potential source of bias, there is nothing that can be done about it at present.

The remaining half of the sample fraction (i.e., $2.59km^2$, or 84 linear kilometer transects) was taken outside potential catchment areas (Figure 4.2). Actually, the coverage amounted to approximately $2.64km^2$ (nearly 88.7km of transects). The noncatchment, or off-catchment, pattern of transects resembled a gigantic web, stretching from one end of the study area to the other. The pre-field work layout of these off-catchment transects was designed so that routes would pass equidistant between the outer circumferences of catchments (Figure 4.2). In the large areal interstices which prevailed at those places where all neighboring circles were nearest, the transects were joined at a common point (Figure 4.2).

These proposed routes were an ideal pattern, because they provided maximum exposure to all sections of the study area. In many cases, it was possible to follow these alinements; approximately, of course, as terrain and access logistics permitted. However, the very fact which made the widely dispersed, lattice-like arrangement of these potential transects so attractive in the first place, i.e., the sample size vis-a-vis sample fraction relationship, was also the major reason preventing exact adherance to the planned routes. We had anticipated terrain and access aggrevations and we had even realized to a degree the problems of getting to and from the widely separated points of origin of the transects, but we had not calculated the enormous time involved in walking these transects which often left the crew considerable distances from field vehicles. As a consequence, well into this phase of the survey after it was realized that the completion timetable was being seriously compromised, the ideal pattern of off-catchment transects was modified to accommodate an off-road or -trail, vehicular-pedestrian, walk and skip, deployment strategy (cf. Chapter 1, for more detailed description of survey procedure).

Thus the choice of transects followed outside of potential catchment areas was dictated primarily by two factors: a) the desire for maximum, areal exposure and b) terrain and access logistics and means of deployment.

The entire matter of sampling looms as a major concern in reconciling survey results with the proposed models and will be considered in greater depth in Chapter 6.

CHAPTER 5

SITE AND ARTIFACT DESCRIPTIONS

INTRODUCTION

Abbreviated site descriptions will be presented in this chapter. The present scope of services required only that data on site size and limits, setting, and kind and degree of post-depositional disturbances be recorded. The scope additionally stipulated that a noncollection policy would be followed. Artifacts were to be retrieved only in cases where they were considered essential to satiating other contractual or research design requirements. Testing was not a requirement of this contract. The limitations placed on data-retrieval techniques meant that a good deal of descriptive information was simply not collected, and the entire burden of descriptive recording was restricted to simple observational notation.

It should be added that restrictions levied on methods in this investigation have in no way compromized the quality or numbers of data assembled by the archeological procedures which were used. It should also be emphasized that a nontesting, noncollecting policy is a perfectly logical procedure for reconnaissance level, cultural resources investigations, which have, in recent years, become increasingly given to statistical expansion of locational information to unsurveyed parts of contruction areas. In other words, it is the location of the cultural resource that has been the primary focus of attention. Other archeological details have not been eliminated or ignored completely. They have merely been deemphasized. As long as reconnaissances, such as the present one, are followed by comprehensive surveys, this policy of seral emphasis (over-emphasis, some might say) on different data sets is perfectly logical, in so far as all investigations are part of single, multi-level, research programs.

The presentation format is simple. Sites will be described in order of the sequence of discovery, first within potential catchments and then within the off-catchment areas. Previously recorded sites will be briefly described in a final section of this chapter. Like the sites found during the present survey, they will be organized for presentation by dint of location within or outside potential catchment areas. Previously recorded sites cannot be used in analyses in the same fashion as ones discovered during the survey because there is no way to control for the intensity and other details of the search procedure which led to their discovery.

SITES LOCATED WITHIN POTENTIAL CATCHMENTS

Catchment 1

Pedestrian coverage of transects covering approximately 13 miles (21km) in length within this catchment failed to reveal any cultural resources.

Catchment 2

Catchment 2 produced a total of four sites, two prehistoric, pottery-yielding locations and two historic, Anglo-American components.

Steinstoff I (BS-3)

This spot is included as a site on the bases of a single, basal sherd of glazed earthenware (perhaps of the local Rhonesboro pottery), and the conviction, based on subjective feel, that the location would have made an excellent living spot. No other artifacts came to light despite intensive surface scrutiny.

FIGURE 5.1. Steinstoff I, view to northwest, crew member Phillips is pinpointing location of sherd.

The find was made on the relatively flat summit of a small finger ridge which extends into the Turkey Creek bottoms (Figure 5.1). The small ridge emanates from a knoll at the end of a large upland ridge, orientated northeast to southwest and delimited by Turkey Creek on the north and a large bottom, occupied by a seasonal stream (tributary of Turkey Creek) on the south. Turkey Creek is a permanent stream and today runs about 125m north of the find. A mature pine overstory dominates at the exact spot of discovery but a mixed hardwood habitat occurs less than 75m to the north and a grassy clearing with shruby oaks, red cedar, yucca, prickley pear, broomsage, and other grasses opens to the south at the junction of the finger ridge and the major ridge complex.

Slope on the ridge summit descends less than 2.C° toward the north but relief in the immediate area is on the order of 1.0-2.0m. Elevation is approximately 420 feet (128m) above msl. Soils within several hundred meters of the find are dominated by Woodtell C and Freestone loams.

No stained earth midden was apparent, and except for the single earthenware fragment no other artifacts were discovered. Hence determinations of orientation, site size and configuration, and other useful details were prohibited.

The solitary sherd, which was not collected, was tentatively identified in the field as a basal fragment of a stoneware utility vessel. The basal diameter of some 10-12 inches (25.4-30.5cm) suggests that the sherd derived from churn, or some other similarly large crock. Whether the sherd is Rhonesboro pottery, made locally during the late nineteenth and early twentieth centuries, cannot be confirmed but is suspected. Whatever the case, origin of the sherd is temporally and culturally identifiable to the period embracing possibly several decades before or after 1900 and to a rural, Anglo-American settlement and economic background.

Except possibly for previous lumbering activities and attendant erosion, the location seems to be in a relatively natural condition. Other human-induced disturbances or on-going natural disruptive processes have not been identified.

Turkey Creek (BS-4)

A few potsherds and stone artifacts are scattered on the ground surface at this location, particularly around gopher diggings and along an infrequently used vehicle trail.

The site occurs on a relatively flat apron of upland surface which lies between the Turkey Creek bottoms to the north and the higher, rugged, hills and ridges terrain immediately to the south. The apron, or fringe, is approximately 50-100m wide. Turkey Creek runs about 100m north of the site, and a small bog, or glade, which

probably contains a spring, lies about 75m west of the site. The site is positioned at the edge of the scarp (increased slope 5.0-8.0°) which marks the break between the elevated apron, or bench, and the overflow plain of Turkey Creek. Elevations on the site surface are around 445 feet (136m) above msl, but immediate relief is about 40m. The site occurs on Bernaldo fine sandy loam but is immediately proximal to soils of the Freestone association.

Vegetationally, the site area is rather open and is dominated by grasses and shrubs. Broom sage covers the ground, and small oaks, pines, red cedar, plums, marsh elder, and huckleberry are interspersed. Immediately downslope (toward the Turkey Creek bottom), vegetation thickens and changes into a white oak-hickory community which shortly gives way to a bottomland association of very large water and willow oaks. The natural vegetation is replaced by a pasture on the east.

Four artifacts were observed at the Turkey Creek site. They were widely scattered over an area measuring at least 30m, north to south, and 125m, east to west (the latter dimension aligned with the long axis of the apron-like landform). Since access to the pasture immediately east of the site was prohibited, the east-west dimension should be judged as minimal. Each of the artifacts was apparently brought up from the subsurface; two of the sherds were found in black dirt from gopher burrows and two other artifacts in ruts produced by wheeled vehicles. Efforts to confirm the subsurface origin and existence of an in situ midden were not successful, despite excavation of numerous trowel holes via an irregular pattern. Some of the small 10-15cm diameter holes were carried to basal red clay without producing midden or artifacts.

The artifacts included: a) one chip of local, brown, pebble chert; b) two plain potsherds derived from the walls of slightly globular vessels; and c) a single rim sherd bearing a Sanders Engraved decoration. The pottery had grit as the principal aplastic. The texture was rather compact and smooth. Cores were dark brown to black, and exterior surfaces ranged from buff to light orange. Although evidence is meager, the Turkey Creek site seems to represent a single component, Sanders Focus site. The residue hints of domestic activities and the setting is certainly appropriate for a living area. In fact, the paucity of cultural materials is surprising because, in terms of simple physical space, the Turkey Creek site area was certainly capable of supporting many more people than would seem to be indicated by the four artifacts. It is conceivable that the site area actually extends further eastward, where survey access was prevented.

Post-depositional disturbances which might have affected the integrity of the site include human activities relating to animal husbandry and fence construction, vehicular access to the pasture across the site surface, and possibly logging. The major damage, however, certainly stems from the extensive soil churning due to gopher burrowing. Other than these conditions and the accelerated erosion which is on-going in car ruts, the site area remains in good, relatively stable condition.

Steinstoff II (BS-5)

Steinstoff II consists of a single stoneware sherd, possibly of the local Rhonesboro pottery, found well down slope of a large upland knoll about 150m east of Murphy Branch. Murphy Branch is an intermittent stream, and the point where the sherd was discovered is near its origin.

The slope depending from the summit of this knoll, which is centered some distance to the east, is about 7.0-8.0°. The approximate elevation is 515 feet (157m) above msl. The soil association appears to be Bernaldo fine sandy loam, and the vegetation is pine-mixed hardwood. Primary species include pine, oaks, hickory, and elm.

The stoneware sherd was broken from a large utility crock of some type. If the Rhonesboro classification is indeed correct, the vessel was probably made in one of the local family kilns sometime between 1850 and 1935.

Steinstoff II probably does not represent a living site. The single sherd would definitely seem to rule against such an attribution, even if the occupants of the farmstead had been impeccable house- and yard-keepers and removed all trash to a distant dump. The steep slope of the hill side certainly would have compromized most domestic activities, and if activities generated from a nearby residence were responsible for artifact loss, the most likely spot for that farm would have been somewhere on the hill summit, some 150-300m away. This prospect could not be confirmed because access to that land was denied.

Erosion around the hill sides has been severe, and the location has been further disturbed by road construction.

Cow Bells (BS-6)

A surface scatter of prehistoric potsherds marked this location as an archeological site. The site was positioned on top of a finger ridge near the point where the ridge terminated in the Murphy Branch bottom. It lay about 150m east, southeast of the junction of Murphy Branch and Sand Springs Branch.

The colluvial toeslope position of the site lies between 400-410 feet (122-125m) above msl. Relief in the immediate area of the exposure is about 10 feet (3.1m). On-site soil is probably Woodtell C loam, while Bernaldo fine sandy loam dominates immediately upslope, and Nahatche clay occurs on the floor of the flanking bottom. Natural vegetation has been removed upslope, and this exposed site area is being reclaimed by shrubs and grass. Prior to clearing, however, a mixed hardwood-pine community would have been present. Upslope, pine would have dominated, but it, too, has been logged-over and has been converted to Bermuda pasture. The adjoining bottom supports a mature stand of mixed hardwood--oaks, elm, ironwood, and various shrubs.

The site consisted of four, small potsherds exposed on the ground surface in an area about 10m in diameter. Careful search beyond this exposure was fruitless. Small trowel holes on the ridge crest within and near the exposure of potsherds revealed an upper zone of dark gray sandy loam, 5.0-10cm thick, overlying a hard red clay. However, no additional artifacts or other cultural refuse and no culturally enriched soil was detected in these small holes.

All of the sherds were plain without decoration; three derived from the body walls of pot-shaped vessels, the fourth was from a rim of a pot or bowl. Sherd interiors were dark in color, indicating reduction. Sherd exteriors were oxidized, ranging from buff and tan to orange. Fabric inclusions were represented by grit and perhaps grog (i.e., crushed potsherds). The lack of decoration prevents a firm typological assignment, but the general resemblance of these materials to the Sanders Focus ceramics from Turkey Creek (BS-4) suggests a similar placement.

The site area has been logged, and a dirt, automobile trail bisects the exposure. Otherwise, post-depositional disturbances seem to have been entirely natural and extensive site damage may be doubted.

Catchment 3

Catchment 3 was not surveyed. It was primarily eliminated from the sample because it contained two previously recorded sites, 41WD31 and 41WD58 (information furnished by Texas Archeological Research Laboratory, courtesy of Carolyn Spock).

Claude Burkett Farm (41WD31)

Little is known about this site, recorded by A. T. Jackson during his East Texas surveys of the 1930s, except that it yielded projectile point fragments and a whole bowl. Jackson's field notes, on file at Texas Archeological Research Laboratory, may have additional information.

Holly Springs Baptist Church of Christ Cemetery (41WD58)

B. D. Skiles, of Mineola, Texas, on authority of B. R. Turbeville of the same town, has located and furnished considerable information on this disused Christian cemetery. Thought to contain 35 to 40 interments, the graveyard has been tentatively identified as one used by the membership of the Holly Springs Baptist Church of Christ (1856-1860) and of the "Liberty Hill Chapel", the latter established before 1856 (B. D. Skiles, unpublished notes, on file with Texas Archeological Research Laboratory).

Catchment 4

Catchment 4 was not surveyed nor does it contain any previously known sites.

Catchment 5

Catchment 5 was also omitted from coverage because it embraced three previously known archeological sites. These sites are briefly characterized below.

McKenzie Mound (41WD55)

The McKenzie site is distinguished by a dome-shaped earthen mound about 18.4m in diameter and 1.8m high. Although damaged by pot-hunters and subdivision expansion, the mound has been subjected to controlled excavations by the Dallas Archeological Society. Doyle Granberry reports that excavations prior to summer 1978 produced a small group of potsherds, a flake, and a Bonham arrow point (Granberry, unpublished notes, on file with Texas Archeological Research Laboratory).

Skiles *et al*. (1980:7) has attributed the McKenzie Mound to the Late Caddoan, Titus Focus, primarily on the basis of the ceramic assemblage and the presence of burned structures near the central part of the mound, a Titus trait.

Holly Lake Ranch (41WD57)

In September 1979, B. D. Skiles and Robert Turbeville, alerted by a newspaper article (cf. *Wood County Democrat*, 27 September 1979, Quitman, Texas) reporting the accidental discovery of a human skeleton at Holly Lake Ranch, visited the location and excavated the remaining portions of an aboriginal burial pit (B. D. Skiles, unpublished field notes, on file with Texas Archeological Research Laboratory).

The skeleton, or rather what remained after house-building and pot-hunting (only the lower limbs) proved to be a Titus Focus burial, as indicated by the small, accompanying Ripley Engraved bowls (Skiles, unpublished field notes). The skeleton had been extended on its back in a shallow pit.

Other burials were not found nor was the locale confirmed as an occupational area. The area had been covered by a modern trash dump, and on-going house construction was interrupted only long enough to exhume the remainder of the burial.

Cranston-Byrd Kiln (41WD107)

This site was recorded by Georgeanna Greer and James Malone, and the following information has been abstracted from their unpublished notes on file at the Texas Archeological Research Laboratory.

The Cranston-Byrd site consists of the ruins of an earthenware manufactory. Three kilns, the clay pit, and foundation outlines of the "jug shop" mark the location.

Using information collected from personal interviews with surviving family members, newspaper articles dealing with contents of old diaries (cf. Wood County Democrat, 2 June 1966), and other sources, Greer was able to put together the following probable reconstruction (unpublished notes, on file with Texas Archeological Society Research Laboratory).

The pottery-making operation was evidently started by a William (?) Teel sometime shortly after 1851. It was subsequently bought and expanded by the C. C. Cranston and John Donaldson families, who, in turn, sold the business to A. S. Byrd, a former employee. Byrd operated the kilns until his death in 1935, and his sons seem to have made bricks and a "jiggered" earthenware as late as 1937. The main items produced in the Cranston-Byrd pottery were varied utilitarian vessels; e.g., flower pots, churns, mixing bowls, and crocks. Salt-glaze wares, from the earliest period of manufacture, gave way to Albany-slipped (brown) wares, which were in turn replaced by Bristol and Michigan glazed wares. Potters' marks consisted of cut and transfer decal numerals and the rubrics, "Rhonesboro Pottery" above the numerals and "Rhonesboro, Texas", below them.

Catchment 6

Catchment 6 was surveyed and produced two archeological sites.

Borrow Pit (BS-1)

This location was confirmed as an archeological site on the basis of two stone artifacts and one fragment of fossilized bone (that may or not be cultural bone), which had eroded from the sides of a large borrow, or gravel quarry.

The site was positioned atop a broad lobe of flat-surfaced sandy alluvium that lay at an elevation intermediate between the base of the hills and the recent floodplain of Big Sandy Creek. This geomorphic surface may represent a period of valley drowning between two major scouring episodes of the Deweyville interval. Whatever its origin, the large alluvial prism is a flat, rather relief-less and featureless plain with a sandy solum extending to depths greater than 50cm below the present surface.

Soils would probably be classified as Woodtell C fine sandy loam. The sands are laden with "gravels" of local reddish-brown ferruginous sandstone and an occasional brown chert pebble. Slope is negligible in the site area, and relief is practically nonexistent. Elevation on a nearby benchmark is 389 feet (129m) above msl. Big Sandy Creek is about 1.5km east of the site, and the nearest water artery is an ephemeral stream about 175m east, a stream so inconsequential, it does not appear on the Shady Grove quadrangle map. A series of "pocks" are scattered north of the location. These circular depressions normally hold water and are often associated with springs or perched water tables. The origin of these depressions is controversial, but differential filling of old river channels (shrinking and compaction of channel-fill clays and other fine clastics) has been mentioned as a possible explanation.

Residual vegetation is mixed pine-hardwood, probably representing second-growth. A pioneer seral stage, i.e., grasses and heliotropic weeds, are beginning to claim the now disused quarry pit.

The two lithic artifacts included a chunk and a chip, both chipped stone technological by-products. They were made of local pebble chert. The artifacts are obviously not culturally, temporally, or even functionally diagnostic.

One artifact lay on the quarry floor and had apparently eroded from the edges of the pit or had been left as residue during dirt- or general gravel-borrowing operations. The other lay in the access road right-of-way. The previous mechanized excavation has apparently completely ruined site integrity. No <u>in situ</u> cultural deposits were detected.

There is absolutely no certainty that the mineralized bone and the artifacts are associated. Even though the bone and the chip were only a few meters apart, both were surface finds on the bottom of the borrow pit.

The bone has not been identified. Its general appearance suggests that it has not been water-transported for any great distance, as it is not worn or polished. The lack of definitive context and the nondiagnostic nature of the stone artifacts prevents a conclusive determination on the nature and age of the site, but the possibility that we have an early man component cannot be dismissed.

Old Well (BS-2)

This is the location of a capped and abandoned oil well located on the edge of a major lobe of alluvial surface at an elevation of about 360 feet (109.7m) above msl. The area has been cleared, and second growth consists of grasses, yucca, and red cedar. Soil association was formerly Woodtell C but has been removed by site preparation.

An H-shaped concrete foundation, measuring 10.3 feet (3.14m) by 20.8 feet (6.34m), and an earthen levee, 0.6m high and 1.0-2.0m wide, are left to recall the human activities at this location. The levee encloses an area (including the old well) about 100m in diameter.

The location is in a relatively undisturbed condition.

Catchment 7

This sample area was eliminated from coverage, and no previously known sites lay within its confines.

Catchment 8

This catchment was subjected to survey, resulting in the discovery of two archeological sites and reports of two others.

Oxbow Return (BS-0)

The Oxbow Return site (BS-0) was located on a low ridge, one of a series of such features that gives topographic expression to an old Deweyville surface in the area. Relief in this ridge and swale complex is nearly everywhere less than 10 feet (3.05m) and thus does not show on the U.S.G.S. Cartwright quadrangle. The concentric arrangement and shape and size of the arcs formed by these ridges and intervening depressions (swales) suggests that they are products of Deweyville alluviation but not the latest episode. The old accretion belt topography has been truncated on both the north and south by subsequent channel scars of a Deweyville-size stream. These later channel segments are now largely filled-in, but their swampy, clay plug character still belies their origin.

The site lies in a Pickton soil association and actually reposes on a plot of Woodtell C loam. It is about 365 feet (112m) above msl and falls in a mixed hardwood community. Today the site is located some distance from nearest running water; Big Sandy Creek is about 500m east. Long Lake, a fingerlike body of standing water in an old thalweg section of the Long Lake swamp (an old Deweyville oxbow scar), is about 300m southeast of the site.

The site was recognized by the presence of two plain potsherds and a single flint chip in gopher diggings which fill this disturbed area along Texas Highway 154. Repeated visits to the location failed to turn up additional artifacts. Thus, neither site size nor orientation could be established. No living surfaces, features, or stained midden deposits were detected.

The potsherds were without decoration, were tan in color (surfaces) with darker (reduced) cores, and contained hard, angular lumps (grog) in the fabric. Cultural attribution is uncertain, but resemblances to the Sanders Focus materials from Turkey Creek (BS-4) are strong.

The site has been disturbed by road construction and by gophers and if the artifacts actually found and the lack of other occupational evidences may be taken as the sum of archeological residues at this location, then the site has been irreparably destroyed. However, since intensive subsurface testing was not done, it is possible that cultural deposits lie outside the disturbed area where artifacts were noted.

Brown Bottle (BS-7)

A solitary fence post and a brown glass bottle marked this location in the Big Sandy floodplain proper. The post, of hardwood measuring four by six inches (10 by 15cm), lay on its side. The nearby bottle was a brown, molded, "med'cine" bottle with a metal screw cap. The disposition of both artifacts suggests that they may have been transported from other locations during high water periods. The site is thus viewed as a secondary deposit, and no further description is deemed necessary since the spot where the artifacts were found is probably not the spot(s) where they were lost, abandoned, left, discarded, or otherwise rendered disfunctional.

Reported Sites

Two additional sites in Catchment 8 were reported to the survey crew by a local informant. The informant indicated that one of the locations (R-1) had yielded numerous, large "arrowheads" in an erosional gully. The other (R-2) had produced pottery and "bird arrows". Neither location was visited by survey staff, but exact locations were plotted on authority of the informant.

SITES FOUND OUTSIDE POTENTIAL CATCHMENTS

Pedestrian transects, totaling approximately 52 miles (84km), were surveyed outside the encircled areas designated as potential catchment zones. A total of five sites were discovered along these alignments, and they are briefly encapsulated below.

Fields (BS-8)

This site is located in the uplands, on a hill summit, 545 feet (166m) above msl. Soils are Kirvin-Bernaldo fine sandy loams, and vegetation cover is dominated by second growth pine and mixed hardwood. Slope across the site area is negligible, 0 to 2.0 percent. The nearest water is an unnamed, ephemeral tributary of Gunstream Lake, some 350m to the west.

A scatter of Anglo-American earthenware and glass sherds, covering an area about 10m in diameter was noted. Blue transferware, plain whiteware, utility stoneware, and clear and colored bottle glass were identified. The area of exposed artifacts lay along an old overgrown road or driveway. About 15m east of the sherd concentration was an elongated pile of asphalt rubble, measuring 90m long, 10m wide, and 2.0m high. The long axis was orientated north-south.

The site is evidently multi-componential; one component relating to a house place probably occupied sometime during the first half of the twentieth century and the second, to the use of the area as a storage area for road-building material (i.e., Texas Highway 2859 about 150-200m to south).

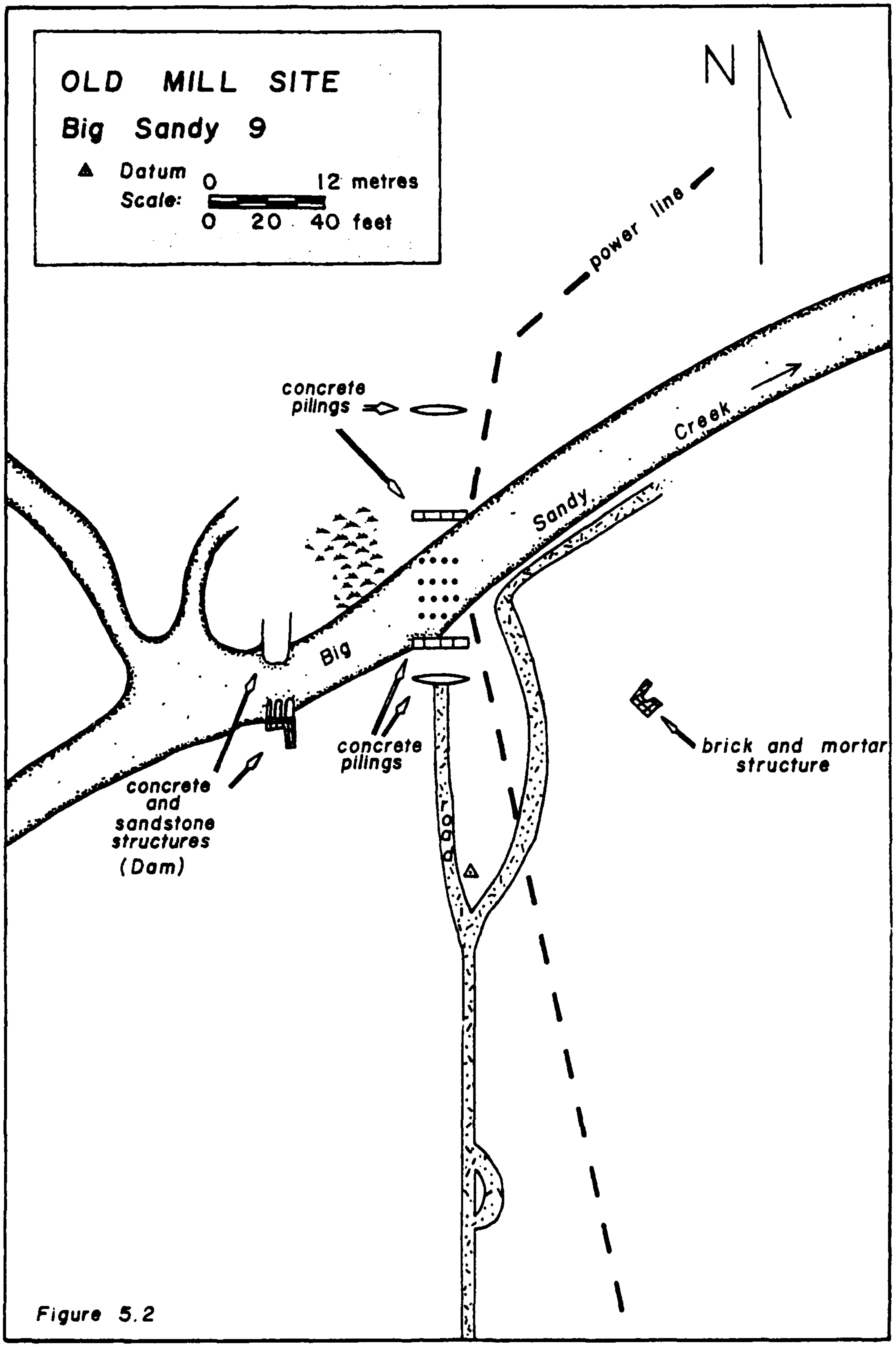
The earlier occupational component has been disturbed by activities associated with use of the area for road material storage. Otherwise the locality in in relatively good condition, having been reclaimed by second-growth.

Old Mill (BS-9)

As the name implies, this site represents the ruins of an old, water-powered grist mill and other associated, or at least nearby, facilities. Structural remnants and artifacts occur in both banks of Big Sandy Creek but are concentrated on the right descending side (Figure 5.2). The soil suite is probably composed of Freestone fine sandy loams with a narrow fringe of Nahatche clays in the creek batture. The creek at this location braids through a composite alluvial prism of Deweyville origin, which reposes between 280-290 feet (85-88m) above msl. Willow and privet line the creek banks, while the higher elevations away from the creek are dominated by pine, red cedar, holly, and oaks and other hardwoods.

A schematic view of the site, based on a compass-tape sketch map, is presented in Figure 5.2. Four main above-the-ground features are present, the dam, bridge pilings, an abandoned road bed, and a foundation for a building.

The dam was made of local ferruginous sandstone slabs and concrete (Figures 5.2-5.3). It formed a wall-like structure, approximately 2.0m across, which bisected the creek batture. Well-preserved remnants of the dam remain on both sides of the creek.



OLD MILL SITE
Big Sandy 9
Datum
Scale:
0
12 metres
0 20 40 feet
N
power line
concrete pilings
Creek
Sandy
Big
concrete and sandstone structures (Dam)
concrete pilings
brick and mortar structure
road

Figure 5.2

FIGURE 5.3. Remnants of Dam on East Side of Big Sandy Creek.

FIGURE 5.4. Bridge Supports for Creek Crossing at Old Mill Site.

About 25m upstream from the dam is an old bridge substructure (Figure 5.4). The section of the bridge on land was supported by solid, concrete and gravel (local ironstone), rectangular braces, two on each side of the creek. The span crossing the creek was underpinned by a series of wooden pilings, ranging between 30 and 46cm in diameter (Figure 5.4). The posts were set in lines of four. Paralleling the axis of the bridge, which was north-south, the pilings were spaced between 2.5 and 3.5m apart. Spacing among posts in each line was between 1.5 and 2.0m.

The bridge lines up with an abandoned road bed which bisects the site (Figure 5.2). The road is elevated and unsurfaced and is overgrown with brush except for the immediate crest where recent traffic leading to a contemporary garbage dump has kept it clear. Large willows, 35-45cm in diameter, presently grow under what would have been the wooden superstructure of the old bridge, suggesting an age of the road and bridge in excess of at least 30-40 years. The minimum age is also supported by the fact that contour lines on the Big Sandy quad sheet, dated 1960, clearly show the road bed but not the bridge. In addition, if the road-bridge complex had been functioning as a major transportation artery during the last several decades, it is unlikely that the pattern of roads which do show on the quadrangle map would have developed as they did.

The remaining above the ground feature at the site is a small, brick and mortar foundation, lying east of the abandoned road (Figure 5.2). This old wall rises only about 0.3m above the ground. It forms an open-sided rectangular feature with the open side facing northwest. It measures 1.07 by 1.77m and is constructed of bricks, laid in a "header-facer" fashion and held in place by mortar. The bricks are solid, lack identifying marks, and measure 21.6 by 10.8 by 6.3 cm (or 8.5 x 4.25 x 2.5 inches).

Located around these structures, particularly atop the right descending creek bank, are scatters of historic Anglo-American artifacts. These consist mainly of broken china and earthenware, bottles, and rusty tin cans. Much of the area is used (and evidently has been used for some time) as a garbage dump, and the materials observed here all seem to represent modern garbage. No artifacts, conclusively dating to the mill period, whatever that may have been (certainly prior to 40-odd years ago and probably during the second half of the nineteenth century), were identified. However, such artifacts may be anticipated around the remaining structures.

The site area retains considerable integrity. Obviously normal decay, weathering, and vegetation reclamation have affected the area, and erosion in the creek will ultimately carry away the bridge pilings and probably the sections of dam which still protrude some 1.0-1.5m into the creek bed. Otherwise, the location seems to have escaped more serious destructive activities. Even the present, continuing use of the area as a dumping ground is simply adding to site growth (i.e., adding another historical and functional component) and preservation.

Roadside (11-J)

This site consists of two exposures of Anglo-American ceramics and glass on both sides of Texas Highway 14. The site (or sites ?) occurs on the slope of large hill, about halfway between the summit (elevation, 168m above msl) and the base, which is marked by an intermittent creek and narrow bottom, connected to Boggy Creek. Elevation in the bottom is around 152m above msl. The artifact concentrations occur at an elevation of about 157m above msl. No bench, or flat apron, exists at the location, and slope is on the order of 3.0-5.0 degrees, which would seem to be rather steep for a house place.

Soils are sandy, and may be classed as Bernaldo or Kirvin. Both exposures occur within the highway right-of-way and are thus devoid of vegetation except for grassy ground cover and a few isolated pines. Flanking the right-of-way is a second-growth stand of pine-mixed hardwood, made up primarily of a pine, hickory, oak, and elm canopy and a grass, cactus, and yucca understory.

Both artifact concentrations covered areas of similar size, ca. 3.0 by 15m with long axes paralleling hill contours. They lay on opposite sides of the highway, about 35-38m apart, and may have been part of a single large site bisected by the highway or more likely two separate sites (house places), positioned on opposite sides of the roadway. The artifact scatters, if indeed they do represent house sites, were obviously produced prior to the construction of Highway 14 as they fall within its cleared right-of-way. However, they could have been associated with an older roadway which provided the alignment for the present highway.

Artifacts from the eastern exposure consisted of eight sherds; three pieces of plain whiteware, three fragments of stoneware, and two pieces of clear bottle glass. The containers were probably twentieth century manufactures.

The locations lie in a highway right-of-way and have been disturbed by road-building activities and subsequent erosion. Depositional integrity is lacking.

Abandoned Farm House I (OH-1)

This site consists of a still standing but disheveled farmhouse surrounded by an overgrown yard and fallow fields (Figure 5.5). Planted red cedars decorate the house site.

The structure is made of lumber and has a tin roof. The porch roof has collapsed. Windows, at least three on one side, have glass panes. The house is of modular construction but exhibits an essential assymetry, atypical of Georgian style of which the house is surely representative. Two windows are placed on side of the door, which appears to be double, and a single window occurs on the other side of the door.

Houses with modular, pen construction, similar to OH-1, are diagnostic of pre-1930, Upland South architecture and construction.

Abandoned Farm House II (OH-2)

This old abandoned house is about 0.7km southeast of OH-1, along the same transect. It is much larger than OH-1 but resembles it constructionally; i.e., built of lumber and bearing a tin roof (Figure 5.6). Cedar and pecan trees surround the yard.

The house is of the double pen or dog-trot type (Newton 1971), the uncertainty produced by the lack of a front view. Other visible traits, however, suggest that dog-trot may be the appropriate designation. In this type, two single pens are separated by a central hall. A front gallery and enclosed back shed run parallel to the side-by-side pens. Both gallery and shed were included in the original building plan (they were not added later) and are covered by a continuous pitch roof (Figure 5.6).

An ell, two rooms long, also seems to have been included from the start. The ell is flanked by a porch (Figure 5.6).

A chimney stands at the gable end of the core. The large size of the house is belied, not only by the presence of the ell, but by its one-and-a-half-story form (probably includes a stand-up, finished attic).

According to Newton (1971:8-9), the dog-trot house was the most common type associated with Upland South culture prior to 1930. A house of the size of OH-2 also suggests that it served as the "big house" on a plantation or larger-than-usual farm (cf. Newton 1971:9).

Reported Off-Catchment Sites in the Project Area

During the course of fieldwork, several additional sites were brought to the attention of the survey team. Information on these reported sites varies considerably. None were visited. They are mentioned here simply for the purpose of recording their existence and to draw attention to the greater range of archeological variability that exists in the Big Sandy drainage basin; a range much more extensive than that revealed by the 13 sites located by ground survey.

Since these reported sites lay outside catchment areas, as well as off-transects, they cannot be used in analyses (Chapter 6). In this regard, they are like those sites reported within catchment sample areas which did not fall along prescribed survey transects.

FIGURE 5.5. Old Abandoned Farm House I, located along Dead Dog Transect.

FIGURE 5.6. Old Abandoned Farm House II, located along Dead Dog Transect.

The analyses in Chapter 6 are enabled by the strict quantitative and qualitative control of the land actually searched to reveal the 13 sites. We simply have no idea of how much or what kind of territory was covered before these additional sites were discovered. As a matter of fact, this kind of information is probably not relevant at all to the context of discovery of these other sites, which, more likely than not, came to light accidentally or incidentally.

Four of these additional sites which fall within project area confines are described below.

1. Sand Pit. Two informants (Bob Skiles and Mr. Poor) divulged this location, which actually lies adjacent to the Old Mill site (BS-9). The area is an extensive sand pit. Artifacts observed in the Poor collection suggest that occupation spanned the interval from Paleo-indian to ceramic Caddo. Examples of Scottsbluff, Edgewood, Yarborough, Kent, and Gary dart points, as well as tiny arrow points made on flakes, were present in the collection.

2. Holly Lake (R3). Reported "Indian habitation" site on the east side of Holly Lake (Mr. R. W. Bailey, personal communication, 1980). No other details were learned.

3. Pinnacle Mountain (R7). Described as a standing historic house with associated well near Union Grove Church (Mr. F. C. Martin, personal communication, 1980).

4. Clear Creek (R6). Reported location of old turpentine camp (Mr. R. W. Bailey, personal communication, 1980).

SUMMARY

A total of 13 sites were discovered along survey transects within the Big Sandy project area. In addition, another 11 sites from project area confines were either previously recorded (Texas Archeological Research Laboratory) or were reported to the survey team by local informants, raising the total number of known archeological and historical occurrences in the area to 24.

CHAPTER 6

ANALYSIS AND CONCLUSIONS ON PREHISTORIC SITE LOCATIONS

INTRODUCTION

As stated in Chapter 1, the Big Sandy cultural resources reconnaissance was:

> . . . predicated on the supposition that if the level of technology and resources used by pre-modern populations can be determined, then the places . . . which occupant groups will chose to exploit and live can be revealed (i.e., predicted) by evaluating the qualitative and quantitative characteristics of natural regions. The working premise allowing conclusions to be derived under this approach is the principle of least effort, . . .

It is toward this goal--predicting site occurrences in the Big Sandy watershed--that the following analyses and arguments are directed.

GENERAL CONSIDERATIONS ON SAMPLING

The raw data produced by the Big Sandy reconnaissance constitute a <u>sample</u> of those observable phenomena (i.e., site locations and characteristics) within the confines of the watershed, or actually from that portion of the watershed which falls within the arbitrarily fixed study area boundaries (Chapter 1). The scope of services specified that the sample fraction would amount to 1280 acres, or $5.18 km^2$. This turns out to represent less than one percent (0.78 percent) of the geographic territory enbraced by the study area limits. Thus from the outset, no matter what theoretical and conceptual dispositions were preferred and no matter the choice of research problems to be investigated and hypotheses to be examined, the crux of Big Sandy investigation rested on its ability to generalize to the larger study area from the tiny sample. That relationship is the subject of discussion here.

Sampling in archeology has recently become a matter of considerable concern. Sampling on a regional level (which would include most reconnaissances and surveys, such as Big Sandy) has been thrust into prominence because of its role in cultural resources management studies, and some attention has been given to evaluating the relative effectiveness of various sampling strategies (cf. Mueller 1974:

Plog 1976; Plog et al. 1978). There are two crucial elements that require examination, both in general terms and specifically as they relate to the Big Sandy reconnaissance; these elements are the conceptual basis on which archeological sampling rests and the question of what constitutes an adequate sample size.

Conceptually, statistical sampling is keyed entirely to making probablistic statements, or inferences, about a universe. A statistical universe may be defined as the total set of empirically observable phenomena (e.g., sites and site characteristics) from which a sample, preferably (but not always) by some systemic means (cf. Flannery 1976: Figure 5.1) is drawn and about which the investigator, by detecting regularities in the sample, can generalize. In a very basic sense, hypothesis-testing is, to a large degree, little more than evaluating the probability that regularities revealed in a sample could have been drawn from a universe, or universes, in which those regularities, in actuality, did not exist. This is usually stated in normal statistical parlance, as confirming or disconfirming the null hypothesis (H_0); the null hypothesis representing a statement which in effect says that the observed relationship between the two or more variables, of theoretical or associational concern, does not really exist, and the detected relationship is due purely to chance. In short, the null hypothesis is the counter proposal to the investigator's statement of relationship between or among variables. If the null hypothesis cannot be disconfirmed within acceptable probability limits, the researcher's hypothesis cannot be accepted.

Thus in a most emphatic sense, an adequate sample is one in which the elements (i.e., observations, sites, etc.) that comprise it have been drawn in a fashion that represents their composition in the universe. As Chenhall (1975) has observed, it is often impossible for archeologists to know directly (or empirically) if a sample is representative or not. We are often not in a position to know the total number of elements in the universal population (e.g., the total number of prehistoric horticultural villages within a single economic, social, or political sphere), even though we have no difficulty defining such a universe and treating it conceptually. This is quite different from, say, a political poll in which voter preferences can be assessed often from a very small sample, because the total number and character of registered voters in any given district is known.

What actually happens in many archeological exercises, including the Big Sandy Reconnaissance, is that the archeologist is told to survey a certain amount or percentage of land within an arbitrarily defined project area. Thus it is actually land that is being "sampled", not prehistoric or historic sites, the total of which constitutes the universe we are really interested in. In other words, the sample is taken from one universe (geographic area) and used to generalize about a completely different one (sites--density, dispersion, and pattern, etc.). There is no magic math that can join these two distinctive universes. There is no statistical procedure that permits one to determine the percentage of sites that will be recorded by sampling a certain amount of ground.

The problem obviously is how to "connect" the universe actually sampled (land surface) with the universe we are interested in (site distribution). The way chosen to link the two universes here is inference, which is a generally used but often implicit approach. As discussed above, archeological inference is not only faced with the problem of generalizing from a sample to a universe but with the additional difficulty of using a sample drawn from one array to make probabilistic statements about a completely different universe. Dealing with these problems practically obligates one to make explicit the theoretical, methodological, and substantive foundation used to join the two universes. This, of course, was the purpose of Chapter 3, and the catchment approach does provide a means of joining land "features" and their distributions with sites and their distributions. Because it argues that elements of one sampling universe (i.e., the land) were directly involved with the agency (i.e., culture) that produced the universe (i.e., site distribution) of relevance and interest to this investigation, the catchment approach succeeds in bridging the gap between the sampled universe and the interpretatively and practically interesting universe--the distribution of site types.

If the catchment approach (cf. Chapter 3) is accepted as a useful means of linking the sampled with the archeological universe, there remains a further problem--sample size. Statistical generalization and hypothesis-testing frameworks presume an exact relationship between sample size, application requirements of certain statistical tests, and probability levels. Thus sample size--the total number of relevant observations (sites)--becomes the critical factor in permitting statements to be made about detected sample regularities with certain levels of confidence. Arguments about appropriate sample sizes have been tended. Binford (1964:434), for example, suggested that a 20 percent sample of the land area would probably be adequate. Chenhall (1975:22), on the other hand, argues that, in some situations, samples of up to 50 cercent of a study area may be required to control for the majority of the site variability. It should be kept in mind that these recommendations refer to the size of the geographic sample fraction and not the number of sites needed to meet statistical test requirements.

In surveys, such as the Big Sandy reconnaissance, in which the sample is to be used for hypothesis-testing and generalization about archeological settlement within a study area, it is important to acknowledge that the <u>power</u> of a statistical test increases as the sample size increases (Siegal 1956:10-11). In this context, power refers to the probability of rejecting the null hypothesis when it is indeed false. The power of a given test is important because the aim of hypothesis-testing is to assess the probability that a particular distribution, or regularity, or pattern observed in a sample is representative of the universe from which the sample was extracted or, in the case of multiple samples, to determine the probability that the samples represent universes that are different. In effect, arguments about what percentage (i.e., sample fraction) constitutes an adequate sample are largely meaningless and irrelevant unless sample size (i.e., the number of observations to be subjected to hypothesis-testing) is considered concomitantly.

The implications of these considerations for cultural resources surveys of extensive land areas may be briefly summarized. Surveys of very large regions may produce quite confident generalizations from small sampling fractions (as expressed in percentage of land area). For statements to be made at the same level of confidence, surveys of smaller areas would necessitate sampling a much larger percentage of the total area. While the use of percentage is a common and convenient way of expressing a sample, it is not synonomous with sample size nor is it a necessarily appropriate means of setting sample size. The point may be clarified with an example. A one percent sample of a universe of a million will permit strong conclusions, based on virtually any kind of statistical test, to be made; a 50 percent sample of a universe of two will not.

DATA ORGANIZATION AND ANALYSIS

The Big Sandy archeological data will be presented in light of the preceding general discussion of statistical sampling. It is in this context that the usefulness of the Big Sandy data can perhaps be best appreciated. It is certainly a conceptual area of considerable relevance to future cultural resource programs in the Big Sandy drainage and therefore of practical utility for planning purposes.

Data Distributions

The following series of tables (Tables 6.1-6.6) sets forth the data categories relevant to analysis under the theoretical and methodological scheme which has governed the present enterprise (Chapter 3, Figure 3.3). The data are organized in a fashion resembling the way a person would set up contingency table tests. This arrangement has been used for two reasons: a) it provides a visual appreciation of the manner in which the site data produced during the survey are to be perceived under the analytical strategy (cf. Figure 3.3) and b) it actually sets up the data distributions in such a way that they could be manipulated. With the exception of those proposed comparisons involving activity structure (Figure 3.3g-h), the order of tables corresponds to the order of statistical tests that were to have furnished the analytical program (Figure 3.3g-n). Data relevant to activity structural comparisons were simply not obtained, hence obviating inclusion of those distributions.

TABLE 6.1. Site Distribution by Catchment *vs*. Noncatchment (Figure 3.3i)

Catchment	Noncatchment
4	0

TABLE 6.2. Site Type by Catchment vs. Noncatchment (Figure 3.3j)

Site Type	Catchment	Noncatchment
horticultural	3	0
nonhorticultural	1	0

TABLE 6.3 Site Distribution by Biocenose Strata (Figure 3.3k)

Uplands	Transition	Bottoms
0	4	0

TABLE 6.4 Site Distribution across Catchment vs. Noncatchment by Biocenose Strata (Figure 3.31)

	Uplands	Transition	Bottoms
Catchment	0	4	0
Noncatchment	0	0	0

TABLE 6.5. Site Types by Catchment Type (Figure 3.3m)

	Catchment Types	
Site Types	Horticultural	Nonhorticultural
Horticultural	1	2
Nonhorticultural	1	0

TABLE 6.6. Site Types by Catchments vs. Noncatchment by Biocenose Strata (Figure 3.3n)

Biocenose Strata	Horticultural		Nonhorticultural	
	Catchment	Noncatchment	Catchment	Noncatchment
Uplands	0	0	0	0
Transitional	3	0	1	0
Bottoms	0	0	0	0

Presentations of two additional data arrays will permit analytical discussion and comparison. To use the distributions shown in Tables 6.1-6.6, it is helpful to know: a) the amount of biocenose covered by survey (Table 6.7), and b) the amount of catchment vs. noncatchment covered by survey (Table 6.8).

TABLE 6.7. Amount of Biocenose Areas Covered by Survey

Uplands	Transition	Bottoms
$1.89km^2$ (36.2%)	$2.89km^2$ (55.3%)	$0.44km^2$ (8.4%)

TABLE 6.8. Amount of Catchment vs. Noncatchment Covered by Survey

Catchment	Noncatchment
$2.52km^2$ (48%)	$2.70km^2$ (52%)

It is obvious at this point that only four of the 13 sites found along survey transects are being used. These four sites are all prehistoric and include Turkey Creek (BS-4), Cow Bells (BS-6), Borrow Pit (BS-1), and Oxbow Return (BS-0). These sites have been categorized or typed as horticultural or nonhorticultural to enable analyses, but it should be admitted that there is absolutely no direct evidence supporting

this breakdown. As the risk of sounding simplistic and guilty of perpetuating probable myths about the inseparability of ceramics and horticulture, three sites (BS-4, BS-6, and BS-0) have been placed under the horticultural rubric because they produced potsherds. Only Borrow Pit (BS-1) was attributed a nonhorticultural designation and that strictly because it yielded only stone materials. As a further comment on the confidence levels associated with this classification, it should be noted that these assignments have been made on the basis of a grand total of 13 artifacts; ranging from single site maximums of four artifacts at BS-4 and BS-6 to a site minimum of two artifacts at BS-1. There was actually only one culturally "diagnostic" artifact among the whole lot and that was an abberant Sanders Engraved sherd from BS-4. Thus there has been no traditional way of grouping components into standard cultural historical or functional types for analytical purposes. Such a breakdown would have not been especially meaningful to the present study anyway, as the interest here centers on the economic role of sites.

Trends

If we can momentarily dispense with two issues which really lie at the heart of these conclusions, we can give our attention briefly to some obvious associations and apparent trends in the data distributions presented in Tables 6.1-6.6. These "trends" obviously cannot be called analytical results supportible by any degree of statistical certainty. The reason for this analytical difficulty is a major conclusion of this study and will be examined shortly. It is also apparent that historic sites, which outnumber prehistoric sites more than two to one, have been omitted from analyses. Had they been included, some of the statistical uncertainty mentioned above might have been eliminated. Why these sites were left out will also be discussed in a subsequent section.

In terms of the empirical catchment approach and the economic models (Chapter 3-4) that have guided data organization and directed conclusions, there are several patterns in the data arrays, given in Tables 6.1-6.6, that hint of directionality, or trends.

1. Prehistoric sites are entirely associated with catchment areas as defined herein (Table 6.1). This seems to mean that the catchment constructs (i.e., nonhorticultural vs. horticultural) are good predictors of prehistoric site locations.

2. Prehistoric sites are entirely associated with the transitional biocenose (Table 6.3). This trend, if upheld, would seem to indicate a definite site locational preference for this spatially and biotically intermediate habitat lying between the bottoms and the hills.

3. There appears to be no association, or relationship, between catchment areas designated as horticultural and the locations of horticultural sites; nor between nonhorticultural catchments and nonhorticultural sites (Table 6.5).

The first two trends, or associations, were predicted by the empirical catchment models. Sites were expected to fall within empirically defined catchment areas, and they were expected to occur in greatest numbers in or along the transitional habitat, which has the highest economic rating of any of the biocenoses.

The third prediction of the Big Sandy catchment models--that horticultural sites would strongly correlate with horticultural catchments and nonhorticultural sites with nonhorticultural catchments--does not appear to be supported by the data distribution. Naturally if this trend was confirmed by adequate data, it would call the present, heuristic catchment models into serious question.

No discussion of potential trends is possible with regard to those projected comparisons based on modeled activity, or procurement, structure within catchments (cf. Figure 3.3g-h). These comparisons were obviated because it was simply not possible to construct meaningful evaluatory models of procurement structure and correlated settlement dimensions. These kinds of data are just not available for East Texas, or for any nearby region that seems environmentally compatible enough to warrant projections to the Big Sandy drainage.

The Elimination of Historic Sites from Projected Analyses

The elimination of historic, Anglo-American sites from these analyses is being discussed in this chapter because the logic and arguments on which this action is based are indeed a principal conclusion of the Big Sandy study. As has been previously intimated and will be discussed at length shortly, one of the major reasons preventing statistical manipulation of survey data and the production of strong, evaluatory conclusions regarding the predictive powers of the empirical catchment models has been the problem of sample size. It might be legitimately questioned therefore that if sample size has been the primary factor short-stopping the statistical program and projections based on its results, why were only four sites included in the data arrays when 13 sites were actually discovered. All 13 were indeed found and recorded in a manner compatible with the research design and strategy and thereby should have been amenable to treatment (i.e., analysis) in a similar manner. On data collection and analysis uniformities there is absolutely no question that all 13 sites are comparable. Why then were nine sites eliminated from analyses?

As mentioned, the sites eliminated from consideration here were all historic, Anglo-American components, ranging from single sherds

of undeterminable contextual origin, through abandoned standing houses, to a disused oil well and grist mill (i.e., BS-3, BS-5, BS-2, BS-7, BS-8, BS-9, 11-J, OH-1, and OH-2). Historic sites are certainly capable of consideration via the empirical catchment approach followed here. As a matter of fact, far greater data precision, hence stronger conclusions, would have been possible had these sites furnished the main data corpus. However, from the outset, the empirical models developed to predict site locations (Chapter 4) were made of input largely based on nonindustrialized groups which accomplished the work necessary to insure adaptation by human labor. This restricted focus was entirely arbitrary on the part of the author and derived from a subjective adoption of investigative aims for which no excuses are necessary. The scope of services, in fact, recognized the need for narrowing project magnitude to a more manageable level (cf. Scope of Services, p. 2): "Data from this study shall be applied toward the solution of a specified subset of these problems."

However, the specific issue to be addressed here is not so much why the investigation was tuned to prehistoric site analysis, but why the specific catchment models, developed in Chapter 4, could not be applied to historic sites and thereby used to strengthen the results of the Big Sandy reconnaissance. To explain why this cannot be done, the following comments are offered.

While there can be no doubt that the concept of a catchment area (i.e., the hinterland surrounding a settlement from which its contents are drawn, cf. Roper 1979:124) is applicable to any given node of human settlement of any magnitude at any time, there is a point at which the catchment concept and particularly specific models based on it may not provide a manageable, or appropriate, analytical framework for investigations of the restricted geographic extent of the Big Sandy project. There are two primary reasons why the empirical models fabricated in Chapter 4 cannot be used to accommodate the historic Anglo sites.

First, the patterns of economic change exposed by Earle (1980) and Christensen (1980) indicate that, as population swells and technology progresses, catchments around sites, communities, or even regions may expand to the point that they embrace so much territory that confinement of a sample to a single reservoir or other contract-stipulated study area may be so restrictive that pattern-recognition is prevented. This author would expect this to be especially true with regard to the two major extractive, economic orientations that dominated East Texas during the twentieth century--the lumber and petroleum industries. As a matter of fact, there may even be a negative, or inverse, relationship between living and work areas under such economies, at least to a certain point. The important thing to remember, however, is that the Big Sandy watershed was far less economically independent during the heyday of lumbering and oil and gas production than it had been during the time of subsistence farming.

A second major factor involves the shift from aboriginal subsistence gardening, hunting, and collecting based on human labor

to first, Anglo subsistence farming and then to commercial farming. The latter two phases of Southern Anglo economy were predicated initially on cheap, conscripted human labor and animal power which eventually gave way to increasing mechanization and dependence on gasoline as a cheap fuel source. The ever-advancing technology on which these changes were wafted, not only placed premiums on arable land as a major resource but came to place heavy emphasis on a developing network of roads along which means of production and finished commodities arrived and by which agricultural products were dispersed. This readaptation caused dimunition in the use of previously important environmental qualities and natural resources and increasing emphases on formerly unimportant or less important ones. Arable land has already been mentioned in the connection. But even arable land came to be redefined because technology now permitted planting where it had not been possible previously. The importance of wild foods diminished considerably, and their influence on settlement founding decisions can be expected to have been rendered negligible. The necessity to locate along perennial streams was cancelled with the advent of the rain barrel, the cistern or well, and eventually water pipelines. The Anglo pattern developed to the point where it can be asserted that large plots of arable land and locations at critical points along transportation arteries (i.e., railroads and highways) are two primary factors "controlling" settlement. These two factors are certainly the principal ones associated with the locations of the Anglo farmsteads recorded by the survey (i.e., 11-J, OH-1, and OH-2).

In summary, the elimination of historic Anglo sites from the analytical program was necessitated because the empirical catchment models were not designed to incorporate them.

Sample Size

The central issue in the analytical program, the one to which attention has been repeatedly turned, is the problem of sample size. The results of data analysis have had to be discussed in terms of associations, or "trends", because it has been impossible to afix statistical confidence to any of the correlations. To reiterate, the main culprit has been sample size. It was determined therefore that an appropriate conclusion of the Big Sandy investigation might be the production of a target sample size; a sample sufficiently large to permit hypothesis-testing and prediction under the present research design within limits of statistical reliability or certainty.

The general problem of archeological sampling has been discussed at the outset of this chapter. The problematical issue of an appropriate sample from the Big Sandy drainage shall now be considered. To emphasize distinctions made previously, the sample to be discussed herein is a sample of archeological sites not a sample of land area. However by extrapolating from site density and dispersion figures produced by the present reconnaissance, it is also possible to come up

with an estimate of the amount of land likely to produce the requisite sample of archeological sites.

Statistical techniques exist for determining analytically reliable sample sizes. One such technique is presented in Cohen (1977:253-267). Its requirements are simple, its use facile. By setting certain parameters and deciding on an appropriate statistic, say chi-square, a reliable sample size can be determined by simply reading a table (Cohen 1977:253-267).

Since the Big Sandy data arrays (Table 6.1-6.6) have been set up in a fashion amenable to chi square analysis, the following procedural discussion shall pertain to that statistical test. Both alpha and beta levels must be set beforehand; alpha, of course, referring to the probability of committing a type I error (rejecting the null hypothesis when it is true) and beta, meaning the probability of committing a type II error, or failing to reject the null hypothesis when it is really false. An effect size must also be set; this paramater meaning that the researcher must put a limit on how small a difference he wishes to be able to detect between the null hypothesis and alternative ones. Alpha, or significance level, is used directly, but beta is used in its reciprocal form, as the power parameter (i.e., how certain the researcher wishes to be that the null hypothesis will be rejected when it is false). Thus by establishing these confidence limits, and determining the degrees of freedom (number of rows minus one times the number of columns minus one) of any specific chi square test, the appropriate sample size can be extracted directly from Cohen's tables (1977:253-267).

Let us propose to test for site distributional differences between catchments and noncatchments and for distributional differences among biocenoses in the Big Sandy drainage. The chi square test for independent samples will be used in both cases. We shall assume an effect size as small as those between alternative hypotheses which propose a site density ratio of three to one (75 percent to 25 percent) for catchment vs. noncatchment respectively and a density ratio of three to one to one (60 percent to 20 percent to 20 percent) across transition, upland, and bottomland biocenoses. The null hypotheses in both cases are the same, i.e., the site density is equal in all areas.

Each test has one degree of freedom. Alpha, or significance, is set at .01, and power is fixed at .90. Determining the values of w (i.e, the effect size index, cf. Cohen 1977:216) gives the figures 0.5 and 0.56 respectively. By referencing the table of sample sizes (Cohen 1977:Table 7.4.1, 253), it is determined that the adequate sample size for both tests is 60 sites, a far cry from the sample of four produced by the present reconnaissance.

While it has been previously argued that drawing a sample from a geographic universe (i.e., land surface) may have little relevance to the cultural universe (i.e., sites) that one is actually interested in, there are means of bridging the gap between the two;

e.g., inference, by inference and extrapolation of empirically determined site densities from neighboring or environmentally similar regions, or perhaps, previous work in the same project area. If we may presume that the site density resulting from the present reconnaissance is an adequate estimator, then we can project the amount of land surface that must be physically covered to produce the statistically reliable sample of 60 sites.

Based on a density of two prehistoric sites per square mile, it would be necessary to survey about 30 square miles (i.e., 19,200 acres or 77.7km^2) in order to acquire the sample of 60 prehistoric sites necessary to produce reliable conclusions using the present theoretical and methodological approach.

This approach is not the only statistical means of determining an adequate and reliable sample for the Big Sandy drainage. Alternative techniques might include applying a formula for the standard error of a proportion (Lazerwitz 1968:285) and using pilot samples (Hammond and McCullough 1974:131). The former technique can be used if the cultural universe can be estimated. While this is an error-fraught projection for most regions which are archeologically poorly known, it would seem possible that the researcher might compensate for estimation errors by increasing sample sizes to accord with the certainty of estimates within acceptable limits of probability. The pilot sample technique, which is applicable only to certain kinds of data, starts with a pilot sample having an N of approximately 30 and from this projects a sample of adequate size.

SUMMARY

All of this concern over sample size and reliability is by way of pointing out that reconnaissance surveys like Big Sandy which often appear to never be able to come to any kind of firm conclusions or to make projections, estimates, or predictions with any degree of certainty are key stages in cultural resources management programs. The Big Sandy reconnaissance was conducted in a practical vaccuum of previously available archeological information and with only intuitive feelings about probable site locations and types. It has produced some trends which can be used to organize future research and has shown some additional avenues worthy of exploration. Furthermore it has decisively presented a target sample size; a figure--60 sites--which not only should provide substantive and reliable results when statistically analyzed under the empirical catchment approach used here but a factor which can be used to make decisions about survey phase work scopes and cost estimates.

CHAPTER 7

PROJECTIONS AND GENERAL CONCLUSIONS

INTRODUCTION

Conclusions on the relationships between empirically derived catchments and a sample of prehistoric sites in the Big Sandy locality were given in Chapter 6. Primarily because only four relevant sites were found during field work, it was impossible to tell if the predictive models were sensitive enough to discriminate horticultural *vis-a-vis* nonhorticultural site locations. The models did *seem* to be able to predict the locations of sites in terms of general area and associated environmental zone. The word *seem* must be emphasized because the relevant site sample was just too *small* to afix any degree of statistical confidence to these trends. Thus the narrowed research objective of the Big Sandy work, an objective selected by the author because of personal interests and applicability to advance cultural resources management planning, as well as because the scope of services said to apply study data "toward the solution of a specified subset of . . . problems", simply did not produce conclusive results. The main factor responsible for inconclusiveness was the apparent low site density. This factor, which smacks of small and/or widely dispersed populations in the Big Sandy drainage, was the one principal variable over which the empirical catchment approach had absolutely no control. It has been determined that 60 sites should constitute a sample adequate to confidently judge the predictive powers of the present catchment models; a sample, which even if low site densities prove real, should be able to be assembled from within a territory no larger than $77.7 km^2$, or from within a sample fraction equalling about 11.8 percent of the Big Sandy project area.

Although the Big Sandy investigation did not produce strong conclusions on the restricted, preselected research inquiry--predicting prehistoric horticultural or nonhorticultural sites using empirically derived catchments--it did generate data and an overall sample of sites adequate to make projections on general site locations throughout the project area. Because the interests of this researcher were restricted in Chapter 6 to the discriminatory prediction of prehistoric horticultural *vis-a-vis* nonhorticultural sites, only four sites out of the available sample of 24 locations were applicable. Here, however, our interests are extended to a much larger field, embracing the entirety of the Big Sandy project area, as well as all known sites. This larger consideration is essential to providing an overall perspective of site locational geography in the area, as well as producing bases for cultural resource management recommendations. By increasing

its breadth, we may thusly use all 24 sites at our disposal and thereby come to some general conclusions on site distribution throughout the Big Sandy watershed. In accordance with scope of services specifications, projections will be conceived in those familiar categories--culture historical units (e.g., Paleoindian culture, Epipaleoindian culture, Archaic culture, Pre-Caddoan culture, etc.).

PROCEDURE FOR TRANSFERING HYPOTHETICAL CATCHMENTS ONTO MAPS

The following procedure was used to delimit the hypothetical catchments which controlled on-the-ground dispersement of survey transects. The logic, theory, method, and data underpinning the empirical catchment approach itself have been given in Chapters 3 and 4. The means used for actually drawing circles representing catchment areas on project maps are described here. This should allow one to retrace the actual steps used by the author in outlining hypothetical catchment circles and in selecting those which would be targeted for on-the-ground survey. It does not necessarily mean that a person following the same procedure would produce exactly the same set of circles. That in fact is quite doubtful. Quite a number of circles could have been drawn. The important thing is that the circles selected for this study were products of an explicit conceptual approach, and reconnaissance results from those areas were amenable to hypothesis-testing; i.e., prediction of horticultural and nonhorticultural site locations. In other words, the significance of this approach is that it is explicitly scientific. The particular zones encircled here or any other possible samples (actual survey areas) that might have been drawn from the project area were not important themselves. As long as the sample--any sample--embodied the predelictions and data set forth in Chapters 3 and 4 it would have been an appropriate choice. The sample selected was after all simply a means to a goal, that goal being the ability to predict the locations of horticultural and nonhorticultural sites.

1. A map of the Big Sandy project area was made by constructing a mosaic from 7.5 minute USGS quadrangle sheets (i.e., Big Sandy, Pritchett, Hawkins, Hainesville, Rhonesboro, Cartwright, and Shady Grove). The only data, added to the composite map at this stage, were previously recorded, archeological site locations and soil types. Site locations were provided by Carolyn Spock (Texas Archeological Research Laboratory), and soil boundaries were projected by comparison with detailed aerial photos from nearby hopkins and Rain counties (Lane 1977). Soil boundaries were drawn in pencil to reflect their inexactness.

2. Every spot which fell along a stream, which had a flat (slopeless) surface, and which occurred at the confluence of two permanent streams was marked by an X. These spots were considered as potential midpoints for catchment circles.

3. Because dozens of circles could have been drawn using these potential midpoints, other considerations were essential to limiting the number and location of those to be used to guide ground reconnaissance. Although operationally this was a rather subjective, trial and error procedure, its outcome was consistent with study objectives to produce a target sample of land areas to be searched in order to evaluate the predictive powers of economic models developed from existing scientific information.

These additional considerations included: a) production of two sets of circles embodying the hypothetical mix of environmental qualities and resources necessary to discriminate between horticultural and nonhorticultural catchments; b) production of a nonoverlapping series of circles; c) elimination of potential circles which fall at least half outside study area boundaries; and d) production of circles so as not to impinge upon land circumscribed around previously known sites, whose cultural affiliation belied the probability of an horticultural or a nonhorticultural economy.

Going from theoretical construction of potential catchments to actual circles on a map involved a certain, expected degree of artibrariness. Just how much "mix" served to define one circle as a nonhorticultural catchment and another as horticultural? The extremes under the models presented in Chapters 3 and 4 posed no classifactory dilemma, but those falling between extremes did. This problem was resolved by making the choice of survey target areas part of the hypothetical construct itself. Hypothetical catchments showing the most extreme "mix" (i.e., nos. 2 and 8) were selected to be surveyed. The two catchments showing the least variation (i.e., nos. 1 and 6) (cf. Table 4.10) were also chosen. Not only were research objectives satisfied by this manner of selection, but refinement of the hypothetical catchment models themselves was an anticipated secondary benefit.

How were these hypothetical catchments actually circumscribed on a map? With a compass and a rule of thumb that nonhorticultural catchments had significantly more uplands and less bottomlands than horticultural catchments (cf. pp. 118-119), light circles were traced around the Xs identified in the previous step.

If the circle drawn did not overlap any other circle, it was included in the potential sample population. If more than half of the resulting circle fell outside study area limits, it was eliminated from the potential sample population. Circles were also eliminated or different nearby midpoints (marked with Xs) were used to adjust the position of the circle if it overlapped any circle having a known site as a center.

Once the study area was "filled up" by these circles (cf. Figure 7.1), off-catchment survey transects were plotted by the following method. Using midpoints provided by the three nearest

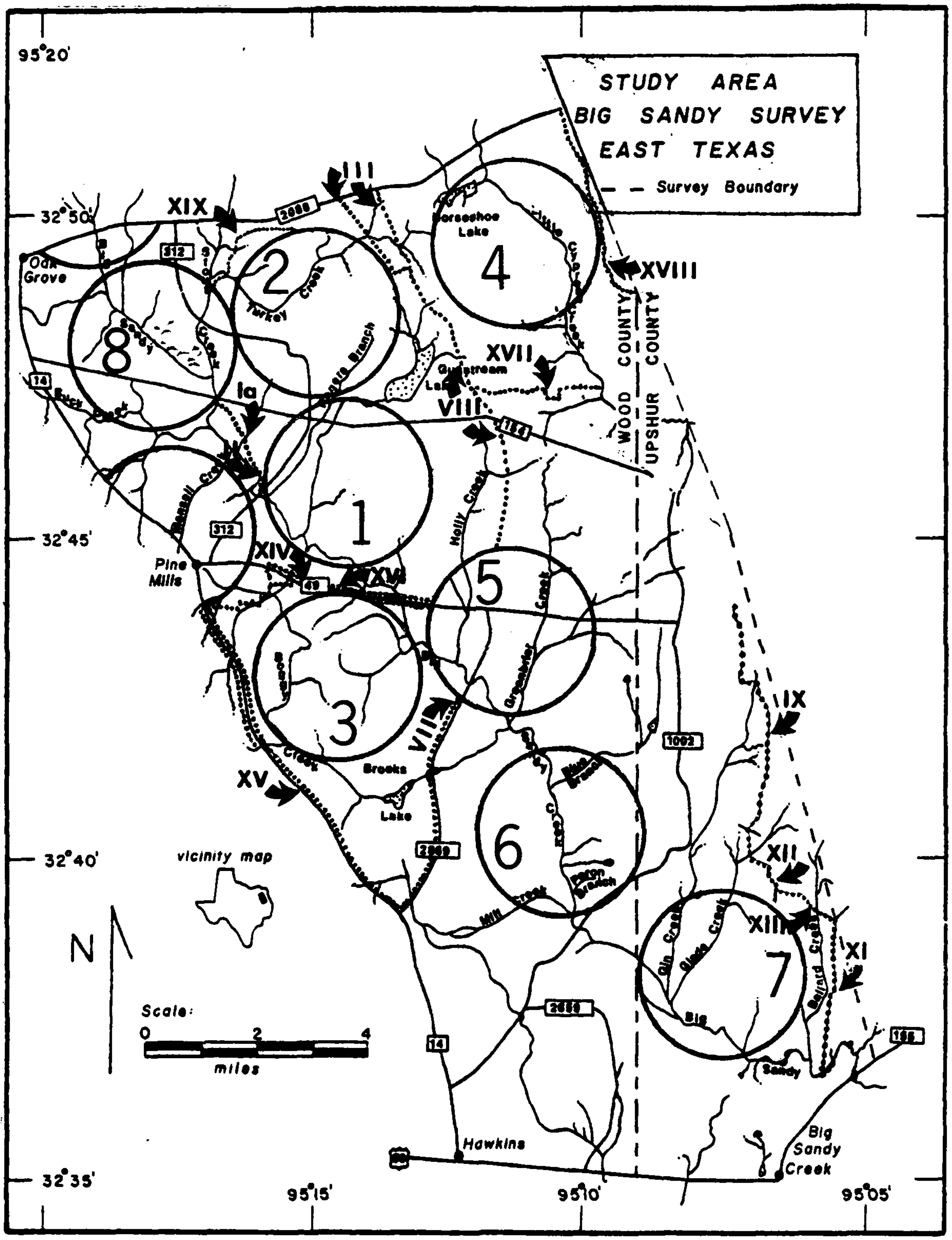


FIGURE 7.1. Routes of Off-Catchment Survey Transects. Shown with dotted lines and labeled with Roman numerals.

circles, a compass was used to draw points through which bisectors were run. These bisectors constituted the off-catchment sample fraction (i.e., transects) and were followed as closely as possible during ground reconnaissance.

TRANSECTS

Ground coverage was restricted to long, narrow corridors, or transects. In keeping with the research design, about half the coverage was slated for hypothetical catchment areas, half for off-catchment zones. Off-catchment transect routes were predetermined by drawing alignments that fell halfway between all hypothetical catchment circles (Figure 7.1). These were followed as closely as possible, but access and scheduling problems led to some rerouting during field work. Exact routes of transects within hypothetical catchment circles were not predetermined but were discretionary. The main objective was to gain as much exposure as possible to those environmental conditions specified by the two catchment models. Transect routes within the hypothetical catchments are shown in Figures 7.2 - 7.5. The general locations of the catchments in the project area are depicted in Figure 7.1.

Surveyed transects totalled 171,195m in length, of which 82,495m (or 48.19 percent) were within hypothetical catchments and 88,700m (or 51.81 percent) were outside. A variety of circumstances compromized the desired 50:50 breakdown. Since width of the transects was arbitrarily fixed at 100 feet (30.49m), transect length provides the major variable for calculating area and hence for determining site density.

Essential transect data are provided in Table 7.1. Each transect segment is identified by a Roman numeral and letter, and its length, expressed in linear meters, is divided according to its dispersion across the three general environmental areas--bottoms, transition, and hills. Within hypothetical catchments, a total of 7372m (8.94 percent) was run through bottoms; 61,189m (74.17 percent) through transition; and 13,934 (16.89 percent) through hills. Off-catchment transects were distributed as follows: bottoms, 6912m (7.79 percent); transition, 33,752m (38.05 percent; and hills, 48,036m (54.16 percent).

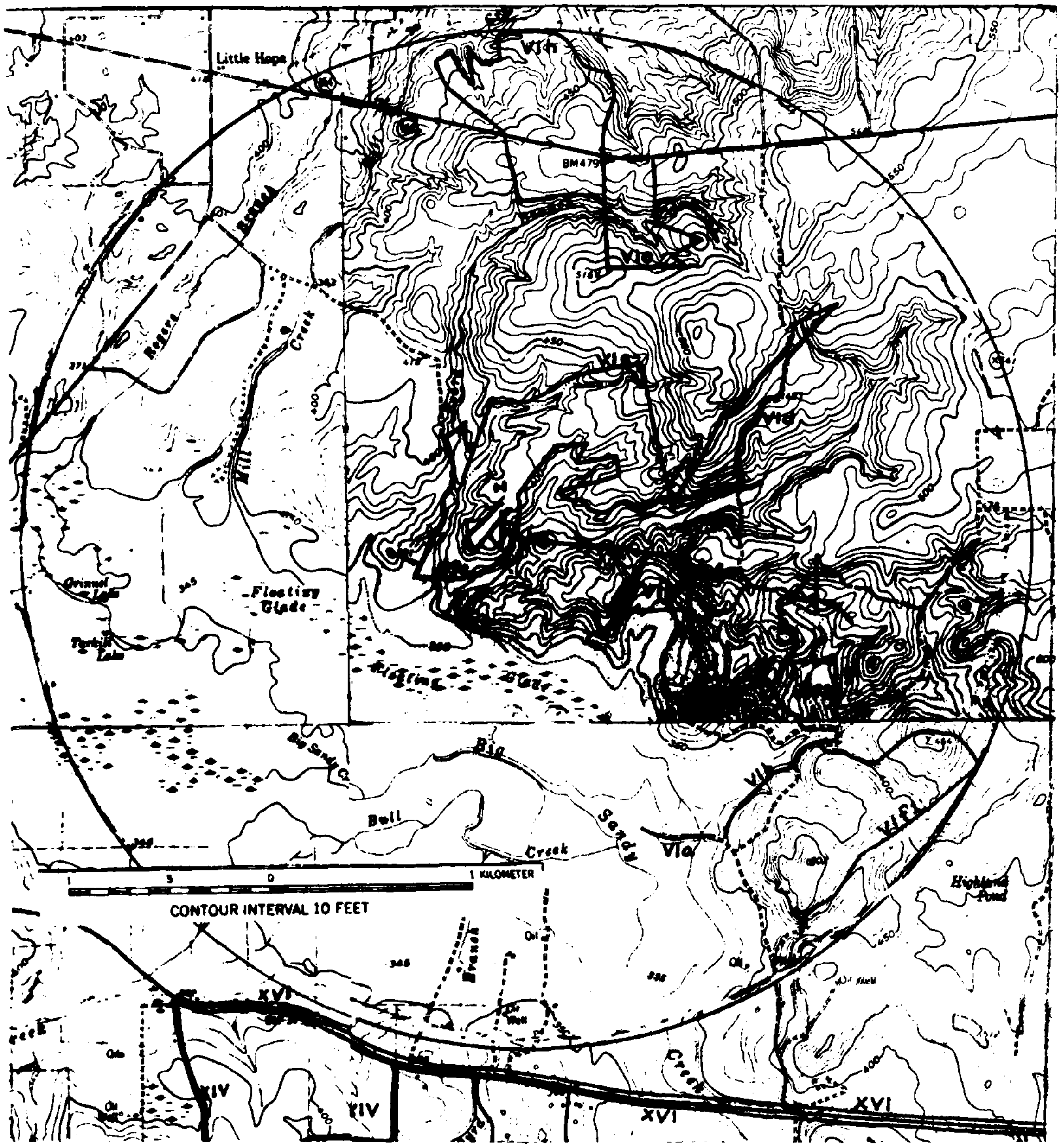


FIGURE 7.2. Survey Transects in Catchment 1 (Floating Glade Catchment).

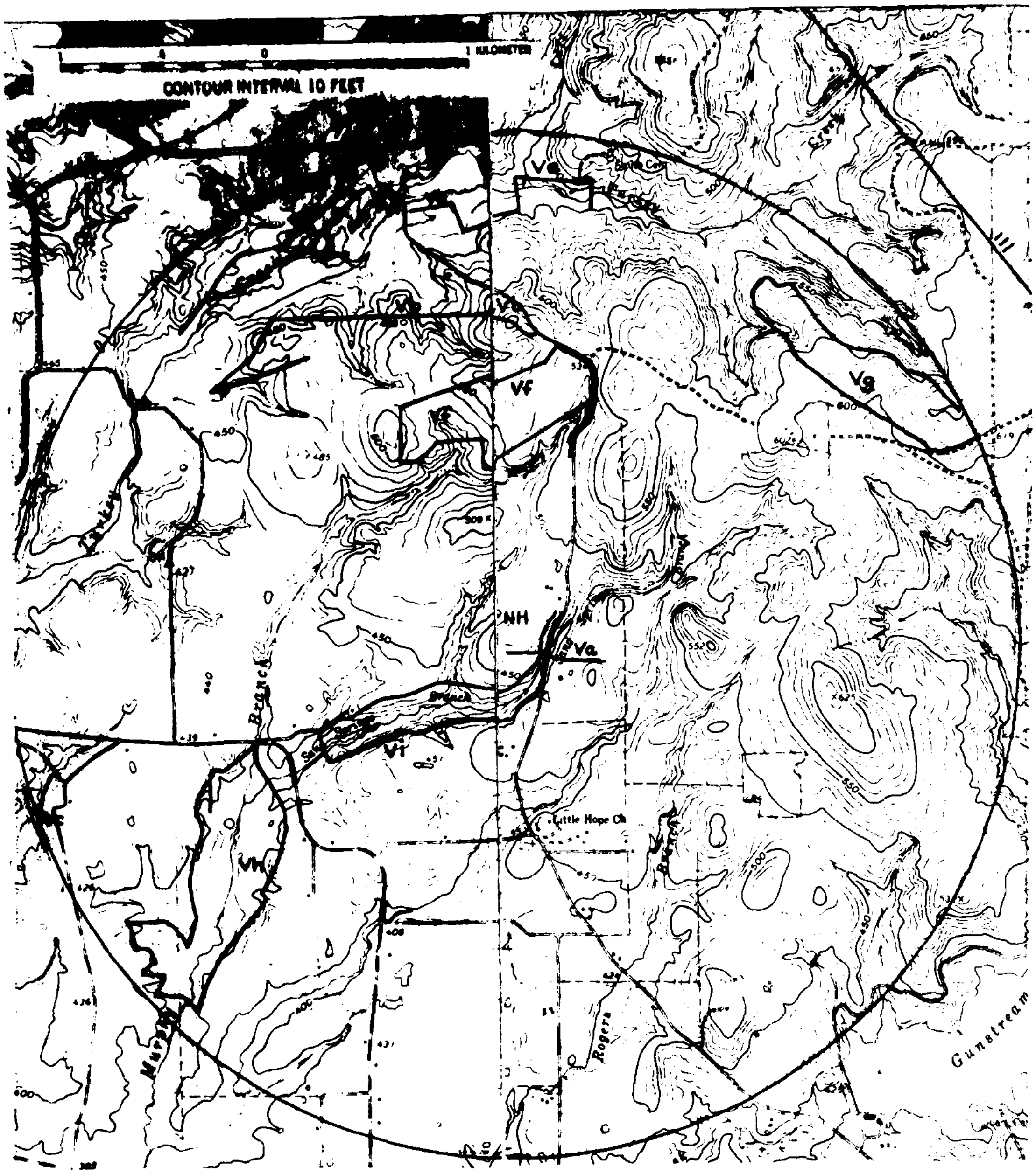


FIGURE 7.3. Survey Transects in Catchment 2 (Turkey Creek Catchment).

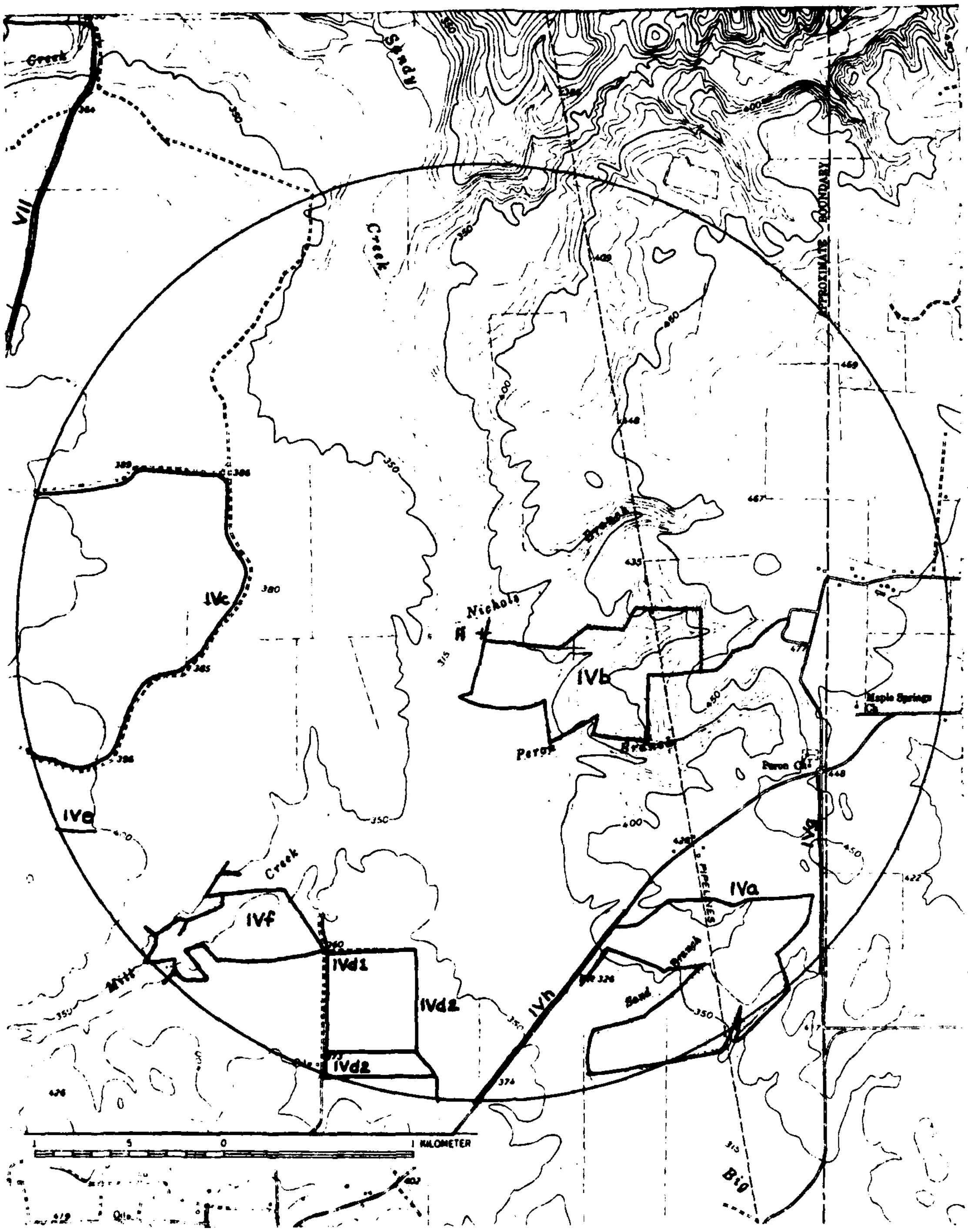


FIGURE 7.4. Survey Transects in Catchment 6 (Nichols Branch Catchment).

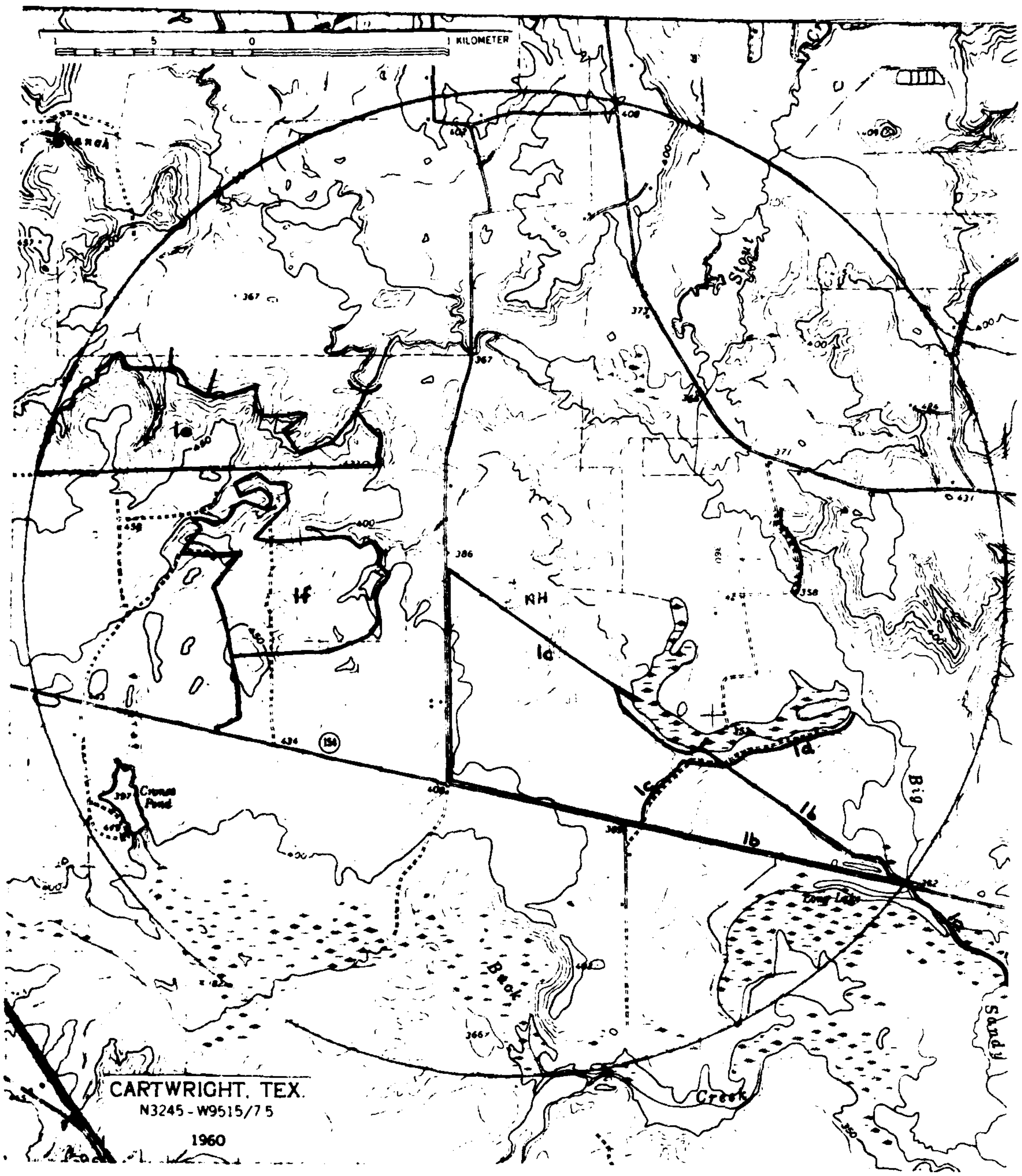


FIGURE 7.5. Survey Transects in Catchment 8 (Stout Creek Catchment).

Table 7.1. Transect Dispersion Via Environmental Zone

Transect	Environment*				Sites
	Bottom	Transition	Hills	Total	
Catchment 8:					
Ib	251	2539	0	2790	BS-0
Ic	0	4490	0	4490	
Id	147	553	0	700	
Ie	255	4836	0	5091	BS-7
If	248	4703	0	4951	
Ig	792	308	0	1100	
Ih	73	357	0	430	
Catchment 6:					
IVa	319	4232	0	4551	
IVb	576	3600	624	4800	
IVc	0	3325	0	3325	BS-1
IVd1	0	1100	0	1100	BS-2
IVd2	0	1950	0	1950	
IVe	0	100	0	100	
IVf	540	3060	0	3600	
IVg	0	814	286	1100	
IVh	317	1003	0	1320	
Catchment 2:					
Va	48	120	312	480	
Vb	0	1020	1105	2125	
Vc	0	350	0	350	
Vd	1173	1492	0	2665	BS-3
Ve	364	811	0	1175	BS-4
Vf	28	28	2769	2825	BS-5
Vg	0	0	2890	2890	
Vh	260	4080	0	4340	BS-6
Vi	699	2331	300	3330	
Catchment 1:					
VIa	425	0	0	425	
VIb	218	3959	174	4351	
VIc	639	4590	581	5810	
VId	0	494	2106	2600	
VIe	0	123	1628	1751	
VIf1-2	0	3007	93	3100	
VIh	0	1814	1066	2880	
Subtotal	7372	61189	13934	82495	

Table 7.1 (Continued)

Transect	Environment*				Sites
	Bottom	Transition	Hills	Total	
Noncatchment:					
Ia	700	0	0	700	
II	1909	391	0	2300	
III	0	0	10100	10100	
VII	964	4895	1557	7416	
VIII	0	0	11722	11722	BS-8
IX	85	852	3321	4258	
X	704	1496	0	2200	BS-9
XI	0	3958	540	4498	
XII	104	1522	1834	3460	
XIII	80	563	2036	2679	
XIV	105	5158	0	5263	
XV	0	718	9533	10251	11-J, OH-1, OH-2
XVI	840	4844	775	6459	
XVII	618	3914	2335	6867	
XVIII	528	2773	3302	6603	
XIX	275	2668	981	3924	
Subtotal	6912	33752	48036	88700	
Grand Total	14284	94941	61970	171,195	

*Numbers in columns represent linear meters.

The decision to limit site density determinations to just three environmental zones requires explanation. Vegetation zones, soil types, elevations, stream rank associations, and a host of other variables, singly or in combination, could have furnished more precise, hence more powerful, estimators. By the same token, breaking down the sites functionally or via some other cultural consideration would have rendered still better density figures. The generality of the density figures produced here is in accordance with the small number of sites--13, found during the present work. If for example, soil types had been chosen as the major units for expressing site densities, only five soils out of 20 to 30 recognized types would have had sites on them. While the observed restricted site-soil correlations may have real value in projecting overall site numbers in the Big Sandy watershed, great portions of the drainage system would have had to be shown as

lacking sites. In other words, while the soil types unrepresented by site occurrences in the present sample may indeed have low numbers and percentage-wise relatively fewer sites than the Woodtell C, Bernaldo, and Kirvin soils (the major site-bearing soils in the present sample), it is doubtful that they will have none. Soils, or any other environmental variable for that matter, in which the number of constituent units (or types or classes) into which they can be grouped exceeds the number of sites in the sample are really too overly precise for assessing site density dispersion at this early stage of projection.

Only 13 of the 24 known sites in the Big Sandy drainage have been used to calculate site densities. These 13 are the ones discovered during the present investigation. Five other sites were on record at the Texas Archeological Research Laboratory (Carolyn Spock, personal communication, 1980), and an additional six sites were reported to the field crew by area residents. The latter 11 sites cannot be used in density determinations because we know neither the amount nor the kind of territory searched in order to produce these sites.

SITE DENSITY ESTIMATORS

A total of 5,219,736m^2, or 5.22km^2, was subjected to on-the-ground coverage. Thirteen sites were found. This provides an average site density of one site per 0.4km^2, or 2.49 sites per km^2. This figure includes all kinds of sites and all environmental zones.

This figure can be used to: a) estimate the number of sites in the entire 660km^2 study area, and b) provide a general standard for discriminating whether site densities from one environment or another are significantly higher or lower than the average and whether site densities for each of the represented culture periods in each of the three environmental zones vary greatly from the norm.

Site density estimators have also been determined for the three environmental zones. These are: bottoms, one site per .44km^2, or 2.27 sites per km^2; transition, one site per .41km^2, or 2.44 sites per km^2; and hills, one site per .38km^2, or 2.65 sites per km^2. As can be readily seen, density estimators for the three environments do not differ drastically from the overall density. It must be kept in mind, however, that the density for the bottoms is based on a single site.

Based on present survey findings, there seems to be a rather exclusive dispersion of sites of various culture periods among the environmental zones. While this observation was not unexpected and is probably reflective of general site patterning, caution must be exercised in using culture period density estimators for projections to the entire Big Sandy watershed. All sites from two environments--bottoms and uplands--were Historic Anglo-American components. The only

Table 7.2. Site Characterization

Site	Environment	Cultural Component
1. Steinstoff I (BS-3) 41WD66	Transition	Historic Anglo
2. Turkey Creek (BS-4) 41WD67	Transition	Sanders, or Caddo II
3. Steinstoff II (BS-5) 41WD68	Upland	Historic Anglo
4. Cow Bells (BS-6) 41WD69	Transition	Sanders (?), or Caddo II
5. Claude Burkett Farm 41WD31	Transition	Titus, or Caddo IV
6. Holly Springs Baptist Church of Christ Cemetery, 41WD58	Upland	Historic Anglo cemetery
7. McKenzie Mound 41WD55	Transition	Titus, or Caddo IV
8. Holly Lake Ranch 41WD57	Transition	Titus, or Caddo II and Historic Anglo
9. Cranston-Byrd Kiln 41WD107	Transition	Historic Anglo pottery kiln
10. Borrow Pit (BS-1) 41WD64	Second Bottom, or Transition	Archaic (?)
11. Old Well (BS-2) 41WD65	Second Bottom, or Transition	Historic oil well foundation
12. Oxbow Return (BS-0) 41WD63	Second Bottom, or Transition	Sanders (?), or Caddo II
13. Brown Bottle (BS-7) 41WD70	Bottom	Historic Anglo
14. R-1	Second Bottom, or Transition	Archaic (?)
15. R-2	Transition	Post-Pre-Caddo

Table 7.2. Continued

Site	Environment	Cultural Component
16. Fields (BS-8) 41WD71	Upland	Historic Anglo
17. Old Mill (BS-9 41UR6	Second Bottom, or Transition	Historic grist mill
18. Roadside (11-J) 41WD72	Upland	Historic Anglo
19. Abandoned Farm House (OH-1)	Upland	Historic Anglo
20. Abandoned Farm House (OH-2)	Upland	Historic Anglo
21. Sand Pit	Second Bottom, or Transition	Paleoindian to Historic (?)
22. Holly Lake (R3)	Transition	?
23. Pinnacle Mountain (R7)	Upland	Historic Anglo
24. Clear Creek (R6)	Upland	Historic turpentine camp

site found in the bottoms was an Historic site. Hence the density estimator for the bottoms, one site per .44km^2 or 2.27 sites per km^2, also expresses the Historic site density for the lowland environment. The same is true of the uplands where all discovered sites were Historic Anglo-American components. Thus the overall site density estimator for the uplands of one site per .38km^2 represents the Historic site density estimator.

In the present sample, all prehistoric sites were confined to the transitional environmental zone. Of the seven sites discovered in this zone, three were Historic Anglo-American, three were Sanders (or Caddo II), and one was probably Archaic. From these empirical occurrences, the following culture period density estimators may be determined: a) Historic Anglo-American, 1.05 sites per km^2; b) Sanders Focus components, 1.05 sites per km^2; and c) Archaic components, 0.35 site per km^2.

Simply projecting these estimators to the 660km expanse of the Big Sandy watershed produces the following expectations: a) total number of sites expected, 1643; b) total number of Historic Anglo-American sites expected, 1138; c) total number of Sanders Focus sites expected, 379; and d) total number of Archaic components expected, 126. Figures for expected number of sites in each environmental zone have not been projected because this would require calculation of the areas covered by each environment.

There is really no way at present to determine the reliability of density estimators or projections based on them. Reliability can only be judged through additional field work. However, there are supplementary data and observations which suggest that the figures should be used merely as general indicators and not as hard, precise factors.

The present survey produced site density estimators for only three major culture periods, i.e., Historic Anglo-American, Sanders, and Archaic cultures. Yet known sites in the study area (information supplied by local informants and the Texas Archeological Research Laboratory) also include Titus, Paleoindian, and other unspecified components. Thus other culture periods are represented in the Big Sandy watershed, but because they were not represented among sites found by the survey, no density estimators could be determined. In this sense then, density estimators are incomplete, because cultural components known to be present would not be counted among those projected for the entire watershed. It must be remembered that site file information cannot be used to calculate estimators for cultural components not represented in the present sample because neither the amount nor the kind of area searched before these file sites were found was recorded.

There is also an uncontrollable effect produced by survey corridor alignments themselves. Where transects were run is obviously where sites were found. When corridors were selected for expediency, as were some of those alternative routes surveyed in the latter days of field work (routes adopted because primary corridors were inaccessible due to hunting leases and other land entry problems), there is the inherent risk that what made the survey corridor expedient may have also influenced settlement (historic and prehistoric sites) along it. This is certainly the case with roads. Roads lead from population cluster to population cluster. In addition, their existence encourages settlement along their alignments. Since some of the off-catchment survey corridors, followed in the final days of the survey, paralleled roads (where public access was guaranteed), there may be a strong emphasis on Historic Anglo-American representation, particularly in the uplands. Prehistoric sites in the uplands would have no necessary affinity for modern roads, unless those roads might have followed old trails. Even so, the affinity of nonindustrial settlement for overland transportation linkages is expected to be far less than for settlement which depended on vehicular commerce.

PROJECTIONS

As specified above, survey data have been used to produce site density estimators for the Big Sandy region. Since the entire region can be divided into three environmental zones, density estimators have been calculated for each zone, under the expectation that site densities and/or kinds of sites would vary by environment. Variation does exist or so it seems. Thirteen sites, however, do not constitute a sample which inspires great confidence, especially in light of the influential circumstances mentioned above. Nonetheless, it constitutes the sample with which we must work, and this discussion will center on some of the projective and anticipatory aspects of the sample which simply will not bear statistical manipulation or mathematical characterization.

Culture periods, known to be represented in the Big Sandy locality, will be used to organize this discussion, and projections of site distribution (i.e., density, variability-dispersion, and pattern) will be made in terms of those familiar units. Maps will be used to show projections.

Paleoindian Sites

Diagnostic Paleoindian artifacts were recovered from the Sand Pit site, along with other artifacts which suggest a range of occupation through ceramic Caddo (personal communication, Robert Skiles and William Poor, 1980). Scottsbluff points were observed in the Poor collection. Inspection of the location, which lies near the Old Mill site (BS-9), failed to produce additional data. The locality is now a large sand pit.

Although not far removed, the Sand Pit site was not on a transect and because it was reported by informants and not discovered as a matter of course, it cannot be used to calculate a site density estimator for Paleoindian sites throughout the Big Sandy vicinity.

As a matter of fact, all the site really allows us to do is confirm the presence of later Paleoindian materials in the region. Its geographic location fails to say much about peculiarities of Paleoindian siting because the same location was also utilized by several later groups, including LaHarpe Archaic and some unidentified Caddoan manifestation. It was, of course, on proposed differences in siting that the predictive catchment models were formulated and by differences in siting that the models were to have been confirmed. When the same location bears more than one archeological component and when the components are from such diverse economic backgrounds as we suspect for the manifestations at the Sand Pit site, then geographic location alone

cannot help in discriminating among predictive models based on economic catchment arguments. If ecological details of the spot, as well as surrounding hinterland, at the times of various occupations were known, then multiple component sites could be used like single occupation sites to evaluate the merits of presurvey models which attempt to specify site locations by quantifying environmental potential.

Epipaleoindian Sites

No Epipaleoindian sites were discovered during field work, and none were revealed through other sources. Thus we do not know whether such sites are really not present in the study area or just have not been found. Regardless, lack of information prevents evaluation of the Epipaleoindian locational model, proposed in Chapter 2, and projections are precluded.

Archaic Sites

Only one site, found during the present survey, has a possible Archaic component, and that site, Borrow Pit (BS-1), was so proclaimed because of the presence of a chip and a chunk and the absence of pottery. This identification is not at all secure. Without diagnostic artifacts, the assignment is based on feeling more than anything else.

In addition to BS-1, the Sand Pit site, reported by Skiles and Poor, has an Archaic occupation(s). Diagnostic projectile points, including Edgewood, Yarborough, Kent, and Gary, were collected by Poor. Another reported site, R-1, located in Catchment 8 but not investigated because of access problems, reputedly had large "arrowheads" and no pottery, according to an unidentified local informant.

Several other Archaic sites near the present project area have been reported (Texas Archeological Research Laboratory, courtesy of Carolyn Spock; Robert Skiles, personal communication, 1980), so there can be no doubt about the occurrence of Archaic sites in the Big Sandy locality. As a further possibility, given the lengthy duration of the tradition and the probably transitory, or semi-sedentary nature of the undoubtedly small Archaic populations in the Big Sandy drainage basin, it is likely that Archaic sites may be far more abundant than the present site density estimator of 0.35 site per km^2 would seem to suggest. Nonetheless by the relaxed standards which govern the present enterprise, this author has no qualms about using the projections, shown in Figure 7.6, as a first approximation of Archaic site distribution in the Big Sandy watershed.

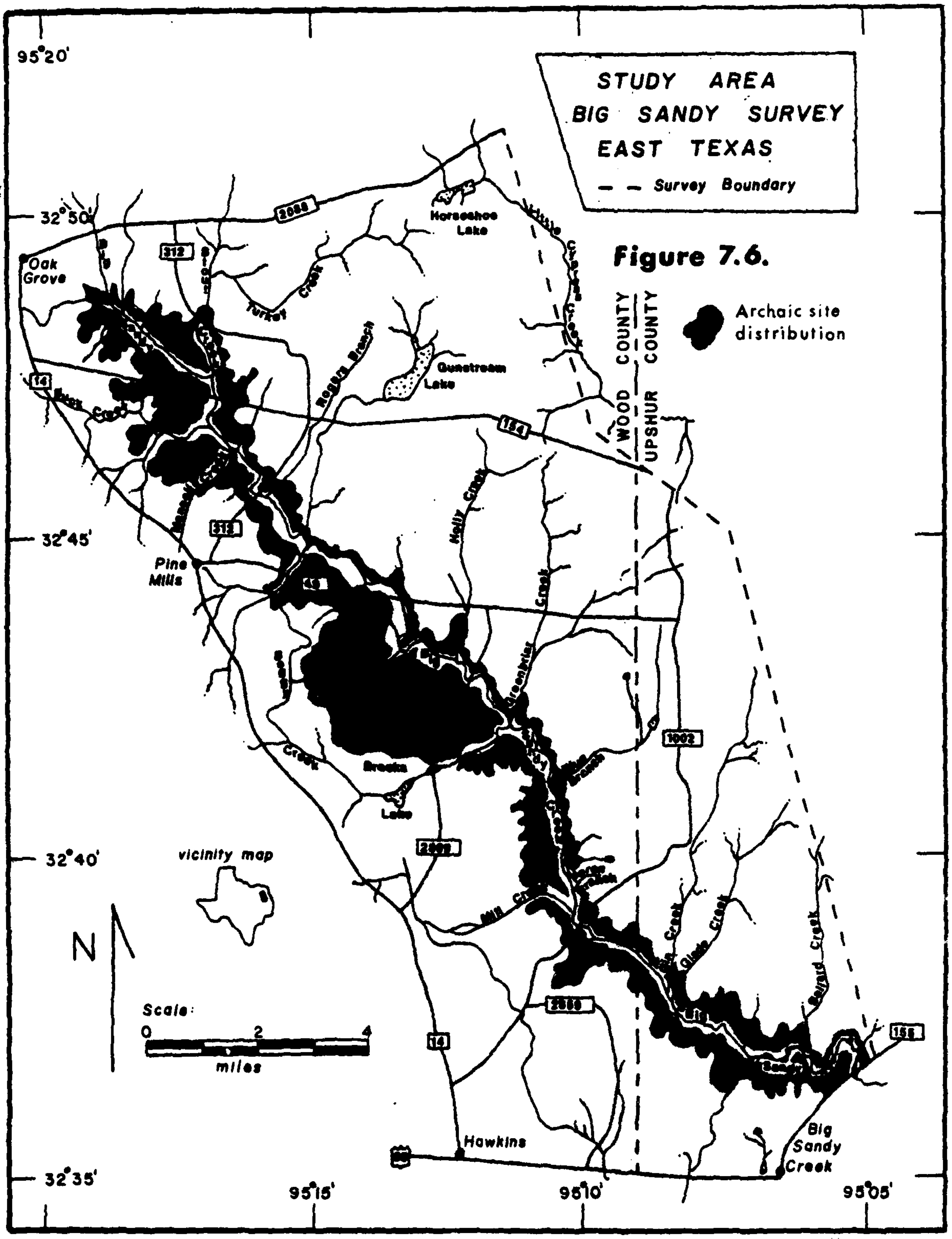


FIGURE 7.6. Projected Distribution of Archaic Sites. PRELIMINARY DATA--DO NOT USE FOR DETAILED PLANNING.

Limiting projected Archaic site distribution to those areas shown on Figure 7.6 is based on the occurrence of all three known Archaic sites in the present study area on Deweyville surfaces. Environmentally, these nonupland, but higher-than-floodplain surfaces are classed as transition zone.

We do not have enough information to even guess at site variability. Archaic sites from the nearby Sulphur, Sabine, and Lake Fork Creek valleys illustrate a considerable range in sizes, probable functions, and duration-periodicity of occupation. These data are not available for the Big Sandy locality.

Similarly, the paucity of information prevents recognition of Archaic settlement pattern. This lack also prevents evaluation of the general settlement model proposed in Chapter 2.

Caddoan Sites

Components of only two Caddoan cultural units are known to occur in the Big Sandy locality. These are manifestations of Sanders and Titus foci.

Sanders Focus, Caddo II

Three sites have been tentatively assigned to the Sanders focus; i.e., Turkey Creek (BS-4), Cow Bells (BS-6), and Oxbow Return (BS-0). Only in the case of Turkey Creek is the assignment made with "confidence". Turkey Creek produced a single Sanders Engraved sherd. Cow Bells and Oxbow Return are listed because the few undecorated potsherds they produced are similar to those from Turkey Creek.

All three of these sites were found along transects run during the present survey, and therefore were amenable to conversion into a site density estimator; i.e., 1.05 sites per km^2.

All three sites were located in the transitional environmental zone. Oxbow Return was positioned out in the floodplain on a lobe of Deweyville surface, like the earlier Archaic sites. However, Turkey Creek and Cow Bells were situated on little creeks in the hills, away from the Big Sandy floodplain (more than 1.0km removed). If these locations are representative, then a shift in settlement, one favoring the edges of small hardwood bottoms along small streams in the hills as opposed to broad flat expanses of second bottoms out in active floodplains, would seem to be indicated. This apparent "trend" seems to continue through the ensuing Titus focus manifestations. If this "trend" was still apparent in an adequate sample of sites, then both

Archaic and Caddoan economic-catchment models, proposed in Chapter 2, would have to be redesigned. At least, alternative settlement structures would have to be proposed to accommodate site distributions, if models were left unchanged.

One hardly needs to be reminded about the wide range of interpretive possibilities from such a small number of sites. The Archaic to Caddo (Sanders through Titus) settlement shift requires a great deal of support before being accepted as a valid historical pattern. However, the present distribution of Sanders focus sites can be projected and mapped (Figure 7.7), without interpretative worry. Figure 7.7 shows a pattern of Sanders focus settlement based on the three sites found during the present survey.

Titus Focus, Caddo IV

Three Titus focus sites--Claude Burkett Farm (41WD31), McKenzie Mound (41WD55), and Holly Lake Ranch (41WD57)--have been reported within the study area. All three sites are cemeteries, or rather contain cemeteries. Just how much domestic activity took place at these locations is unknown, and the possibility remains that burial and residential areas may have been separate. As a consequence, the apparent distribution of Titus focus sites may be only one aspect of the entire settlement configuration.

The McKenzie Mound lies on an elevated colluvial or alluvial prism in the floodplain of Honey Creek, a small hill stream. Holly Lake Ranch, is about a kilometer away, on an apron-like surface half-way down the side of a ridge flanking the same little stream. The situation at Claude Burkett Farm is similar to Holly Lake Ranch, except that a different stream (i.e., Mansell Creek) is involved. Thus, all three known Titus sites are located in the transitional environmental zone along small streams in the uplands. In the case of Honey Creek at least, the stream does not even directly connect with Big Sandy Creek, the master stream in the watershed, but with another creek which then joins Big Sandy Creek.

Since no Titus focus sites were found along any of the present transects, we can derive no density estimators, and therefore cannot project site density. To simply say that the distribution of Titus focus sites is similar to the Sanders pattern is not warranted. Sites of both foci seem to occur in similar environmental situations in the transition ecotone and, as discussed previously, seem to indicate a "movement" or expansion of Caddoan peoples away from master stream floodplains into little creek valleys in the hills. If the Sanders and Titus settlement patterns were exactly compatible, however, then the failure to discover Titus sites along our transects becomes problematic. We found Sanders sites and, if the known Titus sites in any way reflect

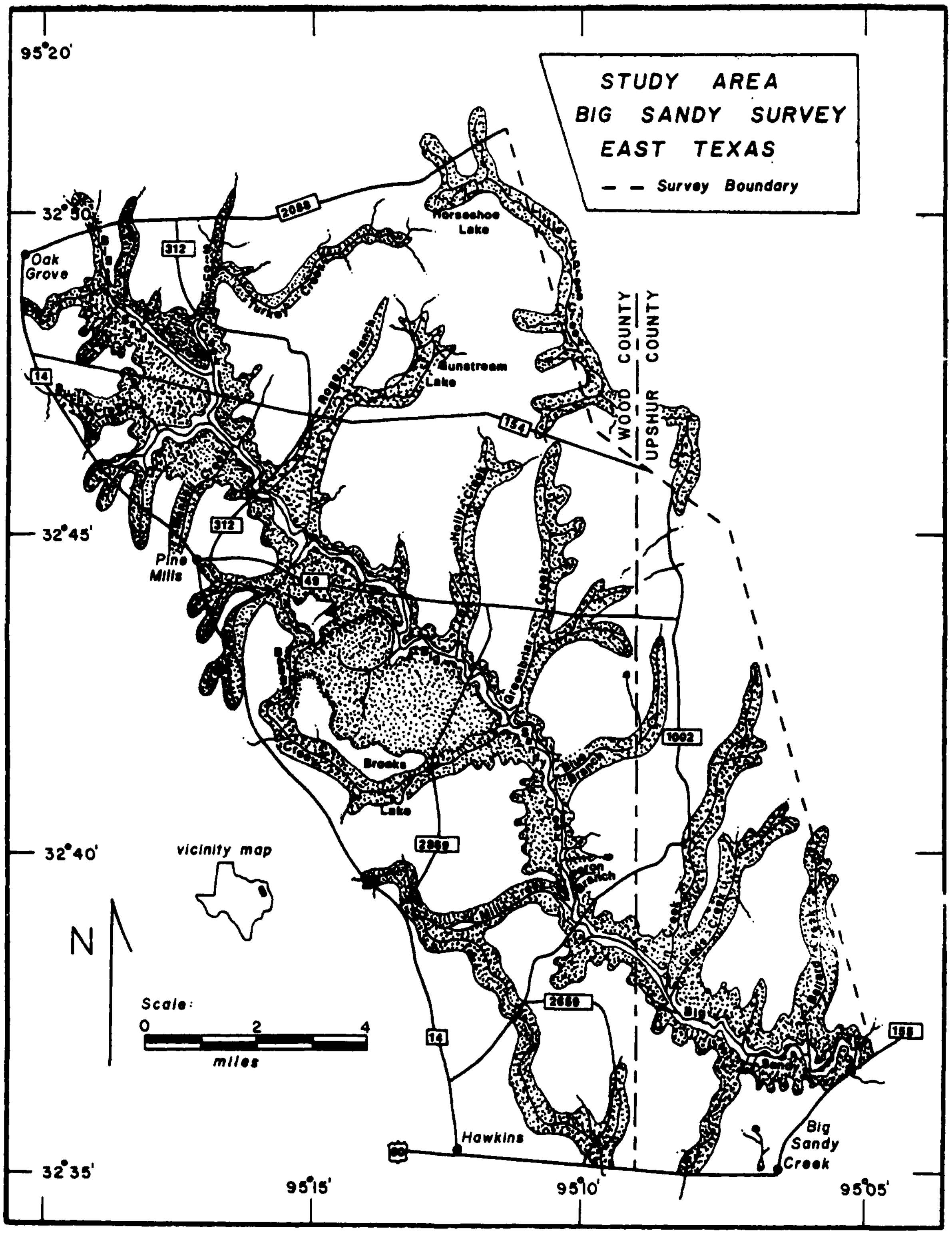


FIGURE 7.7. Projected Distribution of Sanders Focus Sites.
PRELIMINARY DATA--DO NOT USE FOR DETAILED PLANNING.

even a smallish Titus population in the Big Sandy watershed, then we should expect to have encountered Titus sites also. That no Titus sites were found during the present survey cautions against using Figure 7.7 as a possible representation of Titus settlement.

Although again we are arguing on the basis of a tiny sample of sites of unknown representativeness, the distributional data are suggestive. The Titus sites, all previously reported, fell within proposed horticultural catchment circles. In fact, the locations of Claude Burkett Farm (41WD31) and Holly Lake Ranch (41WD57) were used as midpoints to circumscribe 2.5km diameter circles representing catchments 3 and 5 respectively. All empirically defined catchments which contained previously reported sites were purposely eliminated from survey. This methodological decision was predicated on the desire to extend survey into "unsearched" areas, presuming that previously known and reported sites already constituted a corpus of data. By thus avoiding areas where sites were known to exist, it was thought that a more "comprehensive" (in terms of numbers of known site locations only) survey could be conducted.

Unfortunately, it appears that this methodological decision may have stifled an opportunity to encounter undiscovered Titus sites. This admission is based on consideration of the possible effects of settlement phenomena which were not taken into account in the construction of models in Chapter 2. If there had been some sort of affinity, or contagious relationship, among Titus settlements in the Big Sandy watershed, then there would have been no necessary reason why Titus focus sites should have been distributed throughout the watershed, even though preferred locational situations were widespread. The known Titus sites are relatively close together, within 15km. They are cemeteries. If Titus peoples were using the Big Sandy locality to bury their dead and for little else, then the failure to find more Titus sites would be understandable. If Titus folks had only just moved into the Big Sandy area and only a few settlements were ever established, then the lack of Titus sites is also understandable. If the three known Titus sites represent the majority of Titus units that were existed because only a handful of Titus people lived in the area, then the absence of Titus sites along survey routes is still understandable.

Because Titus sites are not represented in the sample of components disclosed by the present survey, and possible factors influencing presumptions of rather ubiquitous distributions are several, it is not possible to project Titus site density in the study area.

Historic Anglo Sites

The majority of sites found along transects were historic Anglo-American components (nine of 13). Several others in the study area have also been reported (Table 7.2). Even casual inspection of quadrangle maps and aerial photographs shows hundreds of historic sites, including buildings, roads, ponds, fields, pastures, and multitudes of other artifices. Since, in many cases, these places, even ones lacking standing structures, are easily recognized, it is no small wonder that they should dominate the present sample. Time has had less opportunity to render them less conspicuous. There can be little doubt, in addition, that Anglo-American populations, out of all those ethnic/racial enclaves who have resided in the Big Sandy watershed, have been the most numerous, though we would not want to say, populous. Because of these factors and, of course, the written documentation of this latest group of folks to reside in the locality, projections of historic (including modern) site densities are most secure (Figure 7.8).

While there are several means of determining site densities, some far more precise than the one used here, the present projections are based on the site density estimator and dispersion pattern disclosed by the current survey of transects. We have chosen to stick with this procedure to retain compatibility and comparability with projections of Indian site distributions.

It should perhaps be reemphasized here that the empirical catchment constructs (Chapter 4) developed in hopes of being able to discriminate between the locations of horticultural and nonhorticultural sites, pertain to historic Anglo-American sites only in a most attenuated sense. The empirical catchment models were formulated as a means of predicting locations of nonindustrial populations lacking draft animals and mechanized means of production. In other words, they were not designed to deal with even the earliest, most austere, Anglo-American situations because factors such as transportation networks, ease and speed of food, goods, and supplies movement, money economy, land tenure and inheritance patterns, and dozens of other critical variables comprising American capitalistic economy and technology were not plugged in. While the development of empirical catchment models for historic and modern, non-Indian populations is certainly possible (perhaps even desirable in view of the present sample of sites), such a prospect would have moved this preliminary study into the realms of economics, historical and cultural geography, and local history--areas of information and methods that were simply beyond present purview (and contractual stipulations).

Though it is improper to compare the present empirical catchment constructs with Anglo-American settlement models, formulated in Chapter 2, we may be confident in the settlement models previously presented because they are products of historical records and personal experience.

The nine sites that comprise Anglo-American representation in the present group of sites found along surveyed transects were situated in all three environmental zones; five in the upland zone, three in the transition zone, and one in the bottoms. The only site in the floodplain, Brown Bottle (BS-7), is probably a derived site; that is, the glass bottle and fence post which marked the location were probably washed there by high water rather than left on spot by primary human activity. In this sense, the density estimator of one site per $.44km^2$ (based on this occurrence) would not have direct behavioral meaning. However, since the archeological record is a contemporary phenomenon (the currently observable product of human behavioral and natural factors resulting in artifact disposition), elimination of this site and of the density estimator based on it is not warranted. Other derived situations--redeposited sites produced by natural, rather than direct human, agency--no doubt exist in the floodplain, and the present estimator gives us a quantitative measure of their numbers.

Other derived sites may be present among sample members. Sites BS-3 and BS-5, both of which produced solitary sherds of domestic earthenware and nothing else, may be downslope erosional residues from distant locations of primary activities. Via reasoning expressed above, they too should be (and have been) retained in the makeup of density estimators.

Aside from rural farmsteads (represented by BS-8, 11-J, OH-1, and OH-2), the present survey sample contains some functionally specialized sites, whose locations are unrelated to landscape food-yielding potential. Site BS-2 is an abandoned, plugged oil well, while BS-9 is the remains of an old grist mill and bridge. Both sites exist at their precise locations because of the presence of certain desirable resources or situations (i.e., oil-natural gas and swift water flow in narrow channel, respectively) that are unrelated to environmental zones, or rather, that distribute independently of environmental type. Such specialized sites would have to be taken into account if behavioral regularities or explanations were being sought. However, since purposes here are merely to provide quantifiable ideas about total site numbers in the study area, all sites, regardless of how or why they came to be, can (and should) be used to produce density estimators.

Figure 7.8 represents area-wide projections based on empirical data produced by the present survey.

CULTURAL RESOURCES MANAGEMENT FACTORS

Composite Projections and Inundation Effects

The focus of interest here (i.e., of management concern) has shifted from the sites themselves, their behavioral correlates-founding

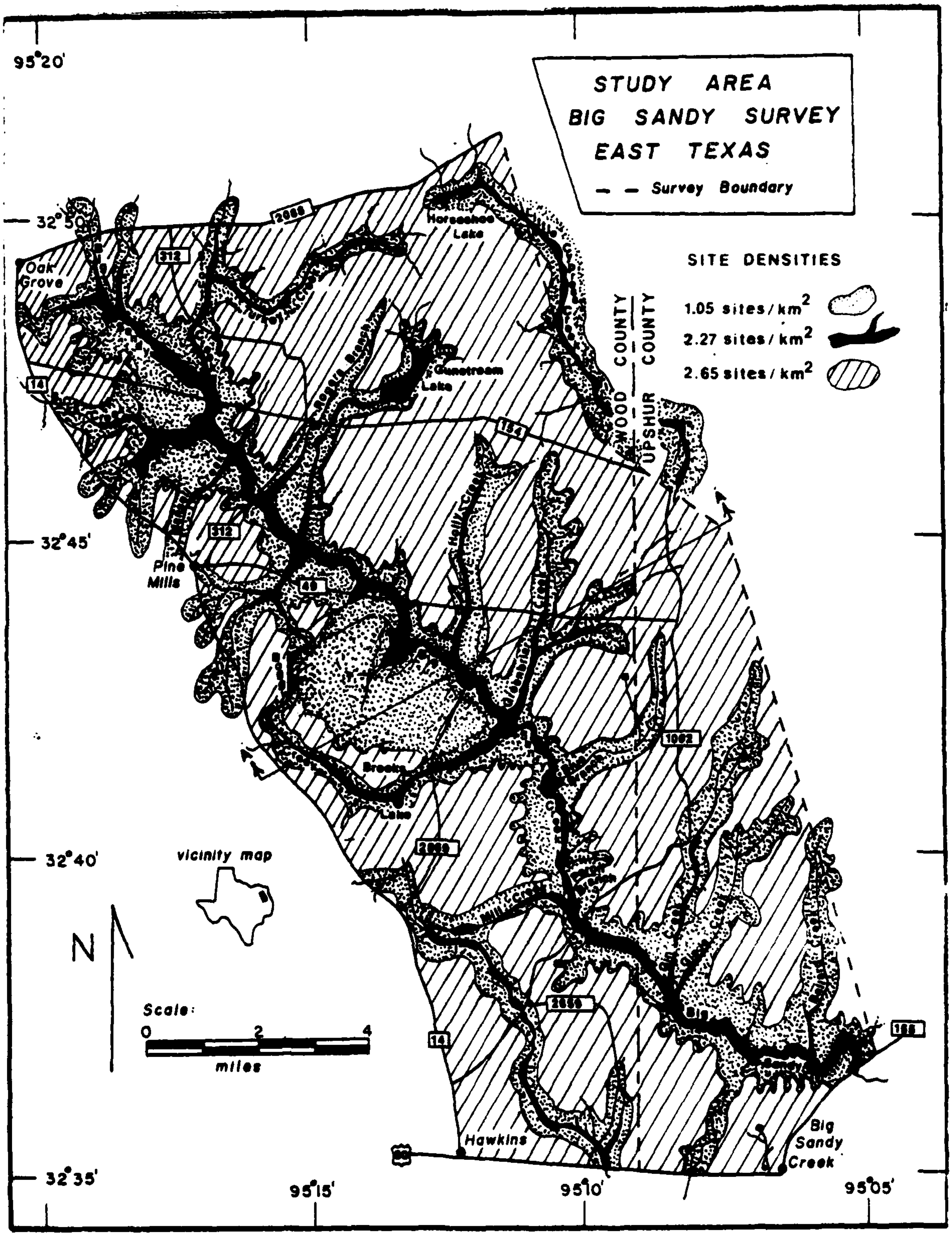


FIGURE 7.8. Projected Distribution of Historic Site Densities in Bottoms, Intermediate Zones, and Uplands.
PRELIMINARY DATA--DO NOT USE FOR DETAILED PLANNING.

criteria, and their arrangement concerning ease of "fit" with desirable, surrounding, economic resources to planning concerns dealing with adverse effects of agency actions on cultural resources and with means and costs of mitigating such effects. Based on foregoing projections, it is possible to produce a map of the project area showing a composite picture of cultural resource distribution (Figure 7.9), and by exercising certain cost factors associated with various kinds of required investigations and mitigation efforts, it is also possible to convert such a map into contoured illustration of projected costs (Figure 7.11).

A composite distribution map is shown in Figure 7.9. Since all of the present study area is classifiable as uplands, transition, or bottoms, the map expresses potential site density across the whole of the Big Sandy watershed. It should be kept in mind that the distributions-densities illustrated are averages. Not every square kilometer which falls within a specified density contour should be expected to harbor the same number of sites as every other one; in fact, considerable variation is numbers is anticipated.

Figure 7.9 is not, however, duplicative of inundation effects nor of mitigation costs. Quite obviously, reservoir construction will only directly impact sites below the 382 feet elevation, the proposed flood level. Secondary and even more "indirect" impacts will result as a consequence of Corps action but since information on pool-side construction actions and projected consequences of reservoir construction itself on the private sector have not been made available to this author, these nonprimary impacts cannot be evaluated at this time.

Figure 7.10 is a schematic cross-section of the project area showing a cultural resources profile of inundation effects. Figure 7.11 shows the extent of inundation (flood level) expressed in terms of projected mitigation costs.

Characterizing sites, discovered during this survey, by elevation above mean Gulf level (mgl, or mean sea level msl) leads to the following projections. Perhaps some 632 sites would be flooded if the Big Sandy reservoir was constructed. Of these, some 126 would be Archaic; 126, Sanders focus; and 379, Anglo American. Untold numbers of Paleo-indian, Epipaleoindian, Archaic (Pre-Caddoan), and Titus focus (among other possible Caddoan manifestations) components might also be affected. Thus, it can be estimated that 38.5 percent of cultural resources within the present study area would be water-covered if the project was completed.

Significance Considerations

Cultural resources management decisions are based normally on not only where and what kind of cultural resources are to be adversely impacted by some governmentally-funded or -authorized project but

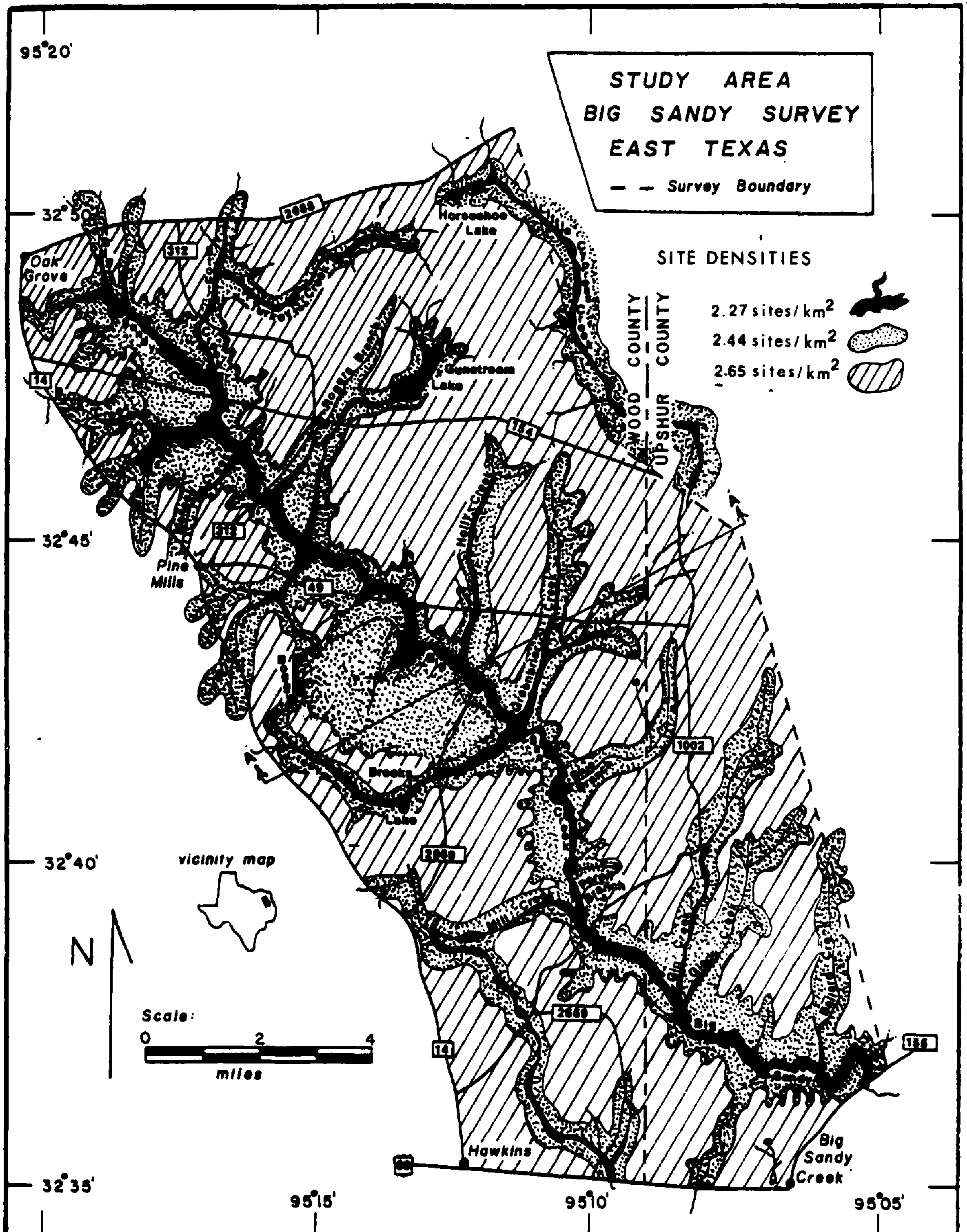


FIGURE 7.9. Composite Projections of Cultural Resources Distribution in Bottoms, Intermediate Zones, and Uplands.

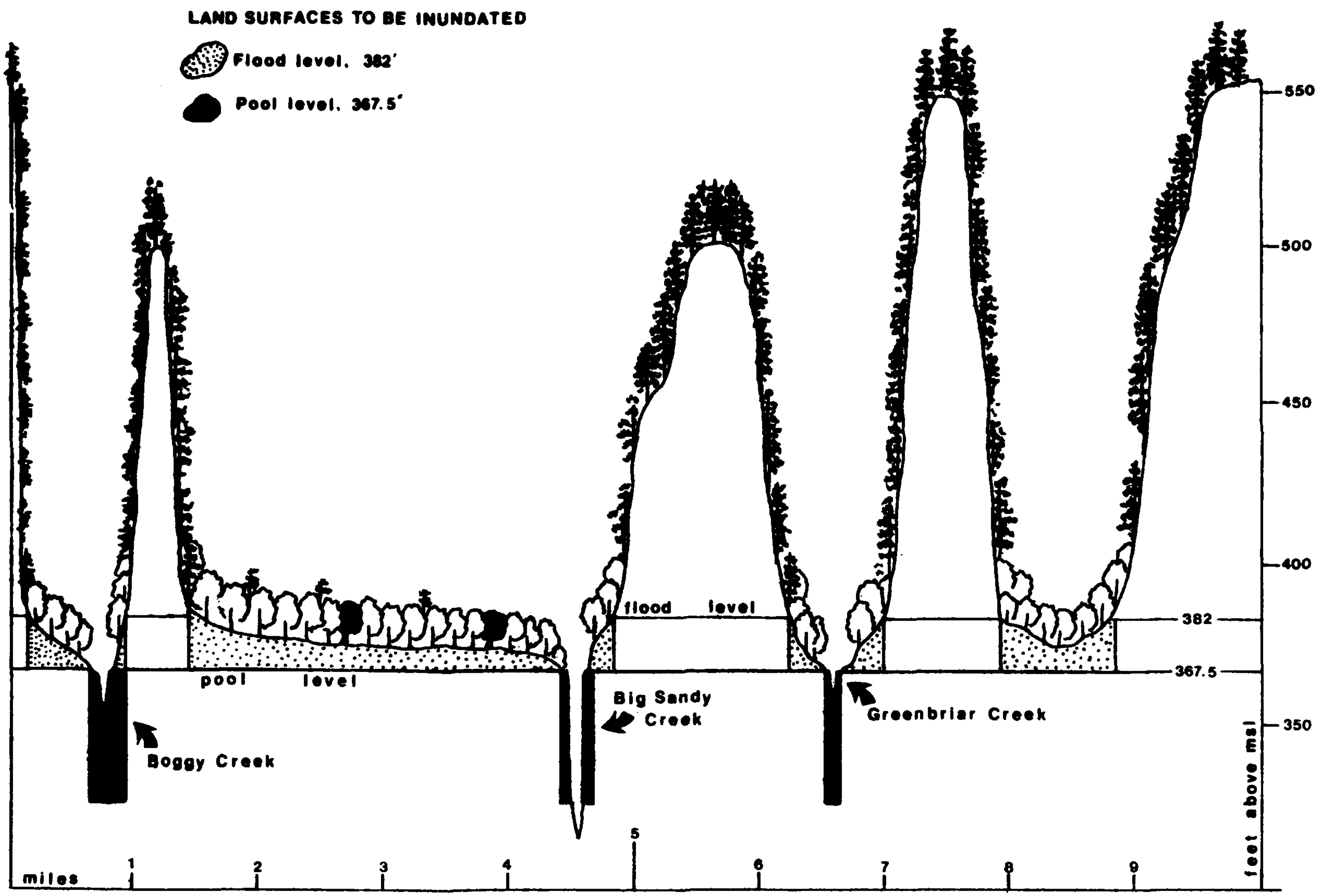


FIGURE 7.10. Schematic Profile of the Big Sandy Creek Area Showing Land Surfaces to be Inundated and Flooded. Location of Transect A-A[1] is shown on Figure 7.9.

whether or not the resources are listed on or have been determined eligible or potentially eligible for listing on the National Register of Historic Places. Only in the case of sites that meet or have the potential to meet Register criteria are recommendations for further investigation and/or mitigation required to be submitted to the sponsoring agency, and only under such circumstances does the agency have further responsibilities to them. Thus in a very real sense, neither Figure 7.9 nor 7.10 represent the extent or full charge of governmental responsibility to existent cultural resources within the project area. Maps of projected distributions of significant sites and of mitigation costs for alleviating adverse project impacts would not necessarily coincide with Figure 7.9-7.10 respectively, if significance criteria established through federal guidelines (cf. 36 CFR 800.10; 36 CFR Part 60.6) were not overwhelmingly based on historical and architectural (hence de post facto discovery) considerations.

That maps showing projections of significant site distribution and of costs of mitigation in the Big Sandy watershed would closely resemble Figure 7.9 and 7.10 respectively and therefore can be represented by the same figures is argued on the following basis. It should be kept in mind that, although Figure 7.9 can be used to represent the distribution of significant sites that would be adversely effected with reservoir closure, the site densities portrayed would be considerably lessened in the case of significant sites.

There are inherent problems in attempting to predict or, as in this case, to project locations of significant or potentially significant cultural resources. A sample of sites, divided into significant and not significant classes, cannot be used to extrapolate potential populations of significant cultural resources. The reasons on which this assertion depend are:

1. Because criteria for judging National Register eligibility are overwhelmingly historically and architecturally orientated, it follows that sites must be first discovered before they can be evaluated for significance. In other words, the eligibility-determining process follows discovery of the cultural resource and recognition that the site bears meritorious qualities. Significance-determination is de post facto. How can one, for example, predict that a given site will have been associated with an historically prominent person, that it will manifest features of architectural importance, or that it will represent the work of a master? If preliminary research is thorough enough and if records give clear locational and confirmational information, we may be able to find such places, whose significance has been judged a priori. This is an entirely different thing from predicting them. Significance is not intrinsic; it is associational, and associations cannot be specified until after the site is found and its worth recognized.

2. Significance-determination is most basically a comparative, hence relative, process. It is fruitless, at present, to try to

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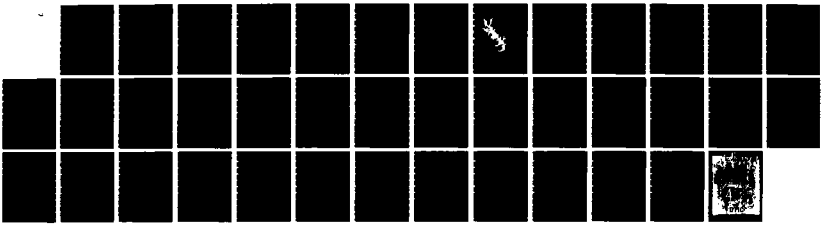

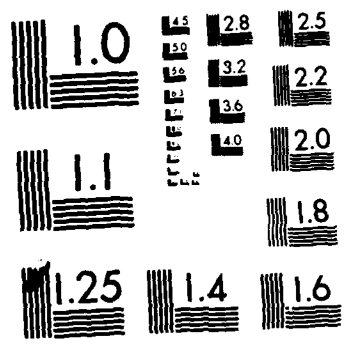

MICROCOPY RESOLUTION TEST CHART
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predict a scale or rank order of cultural resources and to fix a point above which significance will be proclaimed and below which it will be denied. Most recent significance decisions, even those based on explicit, problem-orientated strategies, are relative; the scale being made of profound inquiries, significance being "measured" according to how many questions a particular site may be able to address. The more questions that can be addressed and the more introspective of cultural behavior the nature of the questions being asked, the higher the site will be ranked, and the more likely it will be determined significant. In nonhistorical archeology, this author knows of no way that cultural resources, unique as each is, can be compared before they are found. In other words, significant cultural resources simply cannot be predicted or projected at present.

3. There are a few National Register criteria that could lend themselves to statistical projections based on a sample. Such factors as age in excess of 50 years, in situ condition (or integrity of location, viewed a priori as the reciprocal of extent of ground disturbance), and perhaps even type of construction representativeness (cf. 36 CFR 800.10), could be extrapolated to a cultural resource population, but these criteria by themselves are, in this author's opinion, insufficient to make sound decisions of significance. Other inherent features or qualities of sites that are often included in the significance-determination process, e.g., site size and complexity, can be statistically projected to a target population. However, like the factors of age, integrity, and representativeness, these considerations singly, together, or additively are insufficient to decide whether a site is significant or not significant under National Register criteria. There is nothing intrinsic in the size of a site or in its complexity or in the relationship between size and complexity (i.e., internal differentiation) that espouses significance under National Register guidelines. The factor of uniqueness (which is really a de post facto judgment) quite obviously is not amenable to prediction or projection. How can one project unique sites when being unique means they can have no counterparts?

Since the present view of significance finds that intrinsic site qualities are insufficient foundation to make significance decisions and that historical and architectural biases of Register criteria are incapable of being predicted or projected, there seems to be no way presently to extrapolate the number of significant cultural resources that would require mitigation in the Big Sandy watershed.

There is a means, conducive to quantification and sample-to-population extrapolation, but the bases for operationalizing this significance-proclamation process have not yet been established for the Big Sandy drainage, or for the Upper Sabine region, or for East Texas in general. Such a decision-making context would be predicated on the most generally applicable National Register criterion, ". . . have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR 800.10). The context would have to be produced by an exceedingly critical appraisal of existing cultural

knowledge in terms not only of what is known and how and under what philosophical approach it came to be known but what is not known yet is desirable. In other words, a thorough regional synthesis would have to be prepared; a synthesis which incorporated negative, as well as positive, data; a synthesis which not only put together all the bits and pieces of available information but which identified informational gaps, research issues and problems and presented means of remediation.

Within such a framework, it should be possible to project (and possibly, predict) significance in a fashion suitable for mapping or geographic representation. Naturally sites would still have to be evaluated on their own merits when discovered, but such a synthesis, if well conceived and skillfully transformed, could be used as a means for appreciating potential significance, outside the dimension of site-specific data. We would be able to say, for example, that sites found in preordained situations or under explicitly controlled methodological and hypothesis-testing circumstances would be significant. We would obviously not be able to say that any given site in particular would be significant; just that if discovered under specified conditions, it would be likely to be determined so. By thus being able to control and specify conditions and circumstances, a <u>context</u> of significance can be defined and projected. Site-specific significance determination would still be <u>de post facto</u>.

The Big Sandy watershed is not covered by an existing regional synthesis. Thus in light of the preceding views on significance, this author can see no meaningful way to convert the findings of the present reconnaissance into projections showing the dispersion and density of potentially significant cultural resources throughout the project area. The most that can be said at present is that Figure 7.9, which shows overall site density projections circumscribed by a line representing the extent of adverse impact, can be used as a general picture of the dispersion and <u>relative</u> density of significant sites that will require management action by the agency. This belief is based on the logic that those zones which have absolutely more sites should also have absolutely more significant sites.

<u>Mitigation Costs</u>

Presented in Figure 7.11 are projected costs of mitigation in the area to be inundated. Because of present inability to derive an estimator of the density of significant cultural resources and to extend such numbers to the entirety of the Big Sandy drainage basin, it is really not costs of mitigating significant or potentially significant sites that are being depicted. As is clear in federal guidelines, including the Department of the Army's regulations (cf. ER 1105-2-460, 1978), mitigation is linked directly and unequivocally to significance; significance that is proclaimed and recognized or

that is potential and awaiting recognition. Neither the Corps of Engineers nor any other agency for that matter has a mandated responsibility to mitigate cultural resources that have not been determined to be significant or potentially significant. What is shown in Figure 7.11 are projected relative costs of digging sites--significant or otherwise--that will be adversely impacted by reservoir construction. This illustration is again based on the presumption that zones harboring quantitatively more sites should have more significant sites.

Major inputting variables used to determine and depict mitigation costs include:

1. Pool elevation. Construction plans set the level of the conservation pool at 367.5 feet above msl (112m) and of the flood pool at 382 feet (116.5m) (Robert Burton, personal communication, 1981). Sites falling below these levels will be subjected to direct adverse impact by impounded water and thus will be subject to management action.

2. Excavation. In all cases, mitigation is presumed to be by excavation. No other means of conservation management are feasible when cultural resources are to be inundated.

3. Site Specific Factors. The scope of services specifies that the criteria of site size, disturbance, complexity, and uniqueness will be used to develop relative cost estimates. Since these criteria include both quantitative and qualitative dimensions, it is necessary to assign relative rank order values in order to produce comparability.

a. Three values are arbitrarily ascribed to site size. Sites, larger than 5000m^2 are rated 3; sites between 1000-4999m^2, 2; and sites up to 999m^2 are ranked 1.

b. Amount of disturbance is arbitrarily ranked in three categories. Well preserved sites are assigned the value of 3; partially damaged sites with some residual integrity are rated 2; destroyed components are scored 1.

c. Assigning a rank order to site complexity is problematic, the difficulty owing to the innumerable possible definitions of complexity. To operationalize this criterion for the preliminary projections here, a quite simple meaning is adhered to. Variability in artifact and facilities assemblages from site-to-site is herein equated with complexity. To avoid functional interpretations, only morphological classes and media (or raw material) categories will be quantified. For example, if a site produces portable containers, portable implements, and standing (or otherwise stationary) facilities, it will be scored as the sum of the number of media categories in each class. If a site only produces one morphological class of artifacts, say container fragments, but three media classes (e.g., aboriginal pottery, historic earthenware, and historic glass), it will be scored 3.

Three categories of scores are arbitrarily used as a scale of complexity. Sites having 1 to 4 morphological classes/media categories are regarded as the least complex and are assigned the value of 1; sites with 5-9 groups are ranked intermediate and are given a value of 2; sites with 10 or more groups are the most complex and are rated 3.

d. Like complexity, the criterion of site uniqueness is difficult to ordinally arrange. On the one hand, it can be argued that every site is unique. On the other, one might successfully argue that every site, though unique, is a member of some broader constellation of sites, traits, etc., that is not. A pragmatic definition is adopted here. Sites are ranked on a scale of uniqueness which purports to represent the amount of information available on any particular constellation of places and situations in which the site in question may be typologically assigned and to which the site contributes or has the potential to contribute supplemental or totally new information. Sites which seem to be able to produce only more information of the same kinds available from other sources would be rated as least unique and would be scored with a value of 1. The Old Well site (BS-2), for example, would be assigned to this rank. Information on twentieth century abandoned oil and gas wells is available from other sites which will not be flooded and from other sources (written documents, photographs, etc.) which similarly will not be impacted by reservoir construction. If BS-8, 11-J, and other historic farmsteads, lacking standing structures, were below flood pool levels, they too would be assigned to this rank because better preserved and historically documented, identical or similar situations are known. In an intermediate rank (and given a value of 2) would be those sites, classifiable as components of recognized but not well documented (archeologically or historically) cultural and/or historical units. In the highest rated category of uniqueness (value of 3) would be those sites, representative of various cultural categories, on which no solid information has been previously amassed or for which existent information is either unclear or applies to some particularly intriguing inquiry about human tenure in the locality or about humanity in general.

Since cost estimates must be based on the sample of sites revealed during the present reconnaissance, site specific factors and values for the 13 sites are specified in Table 7.3. Also included for handy reference are site elevations.

Table 7.3. Site Specific Factors and Values

Site	Size	Disturbance	Complexity	Uniqueness	Total	Elevation (feet)
BS-3	1	2	1	1	4	420
BS-4	2	3	1	2	12	445
BS-5	1	1	1	1	3	515
BS-6	1	2	1	2	8	400-410
BS-1	1	1	1	1	3	389
BS-2	3	3	1	1	7	360
BS-0	1	2	1	2	8	365
BS-7	1	1	1	1	3	360
BS-8	1	2	1	1	4	545
BS-9	2	3	2	2	14	280-290
11-J	1	1	1	1	3	515
OH-1	2	3	2	1	7	520
OH-2	2	3	2	1	7	490

It should be pointed out that Table 7.3 has a column for site totals but that figures for each site cannot be obtained by simple addition. This apparent discrepancy is a consequence of a manipulative action designed to bring the relative scaling of sites into an arrangement more compatible with real prospects for mitigation and future financial expenditures. The values in the columns labeled size, disturbance, and complexity were added together, and those totals were then multiplied by the values in the uniqueness column to give site totals.

It is reasoned that factors, such as site size, disturbance, and internal complexity, do indeed influence costs of excavations, as well as decisions as to whether or not to excavate at all. The larger and the more complex a site is, the more it will cost to excavate. Depending on one's objectives, it is also reasonable to say that choices of sites to excavate depend on the degree of preservation, or integrity. If a

site is destroyed, chances are it will not be dug. However, as has been previously indicated, the major canon underpinning mitigation is significance. Uniqueness, as defined and "measured" herein, is the only one of the four criteria (besides the reciprocal of disturbance--integrity) required to be used as cost-fixing factors under the scope of services, that relates directly to National Register significance. Because of its direct relevance to significance, the values in the uniqueness column of Table 7.3 were used as multipliers.

The totals in Table 7.3 thus order the sites found during the present reconnaissance in a fashion which would be compatible to their "importance", whether that importance is defined in terms of National Register significance, recommendations for future investigations, or, as in this particular case, costs of excavation. The cut-off point for "mitigation-cost estimation", represented on Figure 7.11, is 8; those sites with values of 8 and above would, in this investigator's opinion, minimally qualify for additional testing. Hence, only four of the 13 sites, i.e., BS-4, BS-9, BS-6, and BS-0, would require additional work.

All four of these sites fall in the transitional environmental zone. Two lie at elevations above project impact, leaving only two (BS-9 and BS-0) to furnish the projections for the contour lines shown on Figure 7.11. Thus of the seven original sites used to figure the density for the transitional environmental zone in the Big Sandy watershed, only two "important" sites are included. Calculating the density of "important" sites results in the following figure: one "important" site per .72km^2, or 1.38 "important" sites per km^2. This is down from one site per .41km^2, or 2.42 sites per km^2, based on all transitional sites.

The projected site density of 1.38 "important" sites per km^2 can be "transformed" into estimates of mitigation costs via the following formula: average site volume x recommended sample size x excavation unit cost = mitigation total.

The estimated average site volume for the six measurable sites found during the present reconnaissance is 282m^3. The biggest and smallest sites were arbitrarily eliminated in the determination of this figure. It may be presumed that a sample equalling from 5.0 to 15.0 percent by volume will be justifiably sufficient to recover most information, i.e., to satisfactorily mitigate the cultural resource. The excavation unit cost figure used here is \$408 per 1.0m^3. In other words, from digging through final draft report, it is estimated that complete processing of 1.0m^3 of a site's volume will cost around \$408. Thus the average cost for mitigating a "typical" or "average" site in the Big Sandy watershed might range between \$5753 and \$17,258. To say this another way, the average cost of mitigation in the shaded area depicted in Figure 7.11 could range between \$7939 and \$23,816 per km^2.

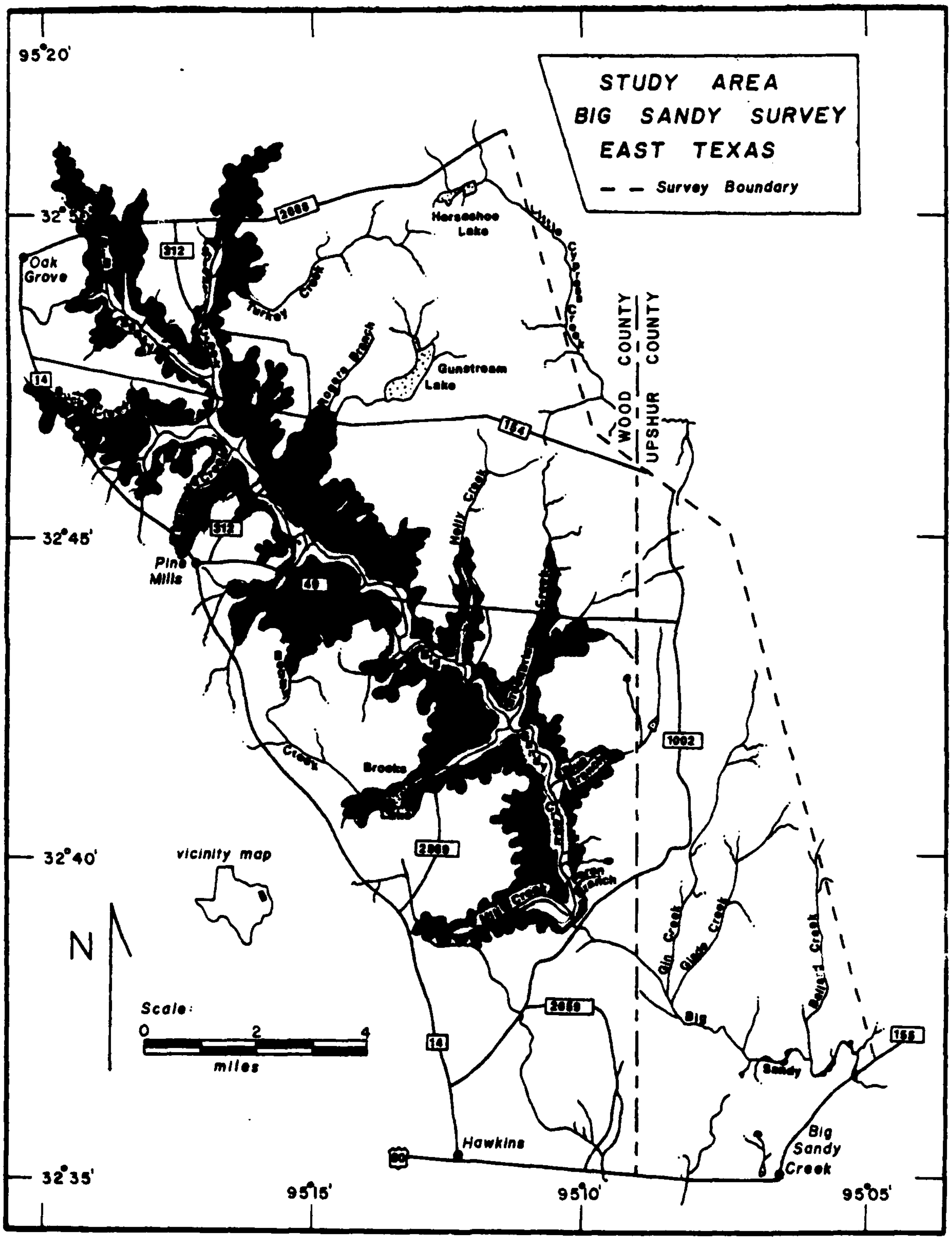

FIGURE 7.11. Projected Costs of Mitigation. Shaded area represents average cost range of \$7939 to \$23,816 per km^2. PRELIMINARY DATA--DO NOT USE FOR DETAILED PLANNING.

SUMMARY AND CONCLUSIONS

Using the 13 sites found during the present reconnaissance, projections, or extrapolations, have been made to the entirety of the Big Sandy watershed. Such projections were enabled by the categorization of pedestrian transects into three major environmental zones--uplands, transition, bottoms--and by the calculation of site density estimates.

Derived density estimates are: a) overall average (all environments), 2.49 sites per km^2; b) density in bottoms, 2.27 sites per km^2; c) density in transition zone, 2.42 sites per km^2, and d) density in uplands, 2.65 sites per km^2. Joining density estimates with dispersion information permits us to project the total number of expected sites in the study area -- 1643. Of this total, it is estimated that 1138 sites will be of Anglo-American derivation, 379 of Sanders focus origin, and 126 of Archaic origin. This breakdown of sites by cultural origin is not entirely representative, because numbers of Paleoindian, Titus focus, and other unspecified cultures have not been specified. Previous information reveals that such components are present in the Big Sandy watershed, but their absence in the reconnaissance sample precludes projections.

The conservation pool level has been set at 367.5 feet above msl and the flood pool at 382 feet above msl. Given these water levels, it may be estimated that 38.5 percent of the cultural resources in the project area will be inundated. This could be as many as 632 sites; the majority of which, or 379 sites, would probably be Anglo-American components. The remaining 252 sites would probably be equally divided into Archaic and Sanders components.

Because significance, in the absence of local and regional syntheses "establishing" a priori contexts of significance, is a de post facto process, there is no way at present to estimate the number of significant sites in the proposed reservoir. Generalizing from the reconnaissance sample, however, makes it possible to estimate the number of "important" sites. Importance has been defined in terms of size, complexity, uniqueness, and disturbance; factors which are spurious or only indirectly related to National Register significance but which are amenable to the derivation of mitigation costs. Survey data provide an estimate of 1.38 sites per km^2 in the flood pool.

If we make the equation that the estimated density of "important" sites equals the density of significant sites, then by plugging in excavation costs and average volume of Big Sandy sites, we are able to produce estimates of mitigation expenditures. A cost range between \$7939 and \$23,816 per km^2 is derived.

The preceding projections and estimates should be regarded as first approximations of the cultural resources base in the proposed

Big Sandy watershed. They are based on systematic and controlled survey of a tiny 5.22km^2 fraction of the 660km^2 study area. The survey coverage was purposive and nonrandom. Randomness was not consistent with the specific research design set up to ascertain if certain empirically defined catchment models could be verified by predicting different settlement structures associated with two broadly distinctive economies. While that effort was not as successful as desired, due to its crudity, its outcome was suggestive and directional. Nonetheless, the sites revealed during field work have provided the point geometry and environmental associational qualities essential to projecting numbers and kinds of sites throughout the proposed reservoir. It is toward the proper conservation management of these cultural resources that this preliminary effort has been directed.

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APPENDIX I

ANNOTATED LIST OF NONBIBLIOGRAPHICAL SOURCES OF INFORMATION

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ANNOTATED LIST OF NONBIBLIOGRAPHIC SOURCES OF INFORMATION

<u>Anonymous</u> Address Unknown	Old gentleman, who lives slightly north of the giant oxbow scar on the Cartwright 7.5' quadrangle. Informed the field crew of sites R-1 and R-2.
<u>Bailey, R. W.</u> Address Unknown	Lives in Wood County near Upshur County line on Texas Highway 45. Reported sites R-3, R-4, R-5, and R-6 to field crew. Very informative and helpful. Has considerable landholdings in area and family has lived here for long time. Extremely valuable contact.
<u>Baker, Max</u> Box 239 Quitman, TX (214) 569-2792	Is County Agent for Wood County and is knowledgeable about area, particularly soils. Informed crew that detailed soil maps for Wood County are being prepared.
<u>Caddo Indian Museum</u> Longview, TX	One attempt to visit Museum on Saturday afternoon found it closed. Reputedly has collection of 30,000 Indian artifacts from area. Mr. Skiles recommends Museum and its founder (name not learned) as good sources of information. The founder reportedly has a knack for discovering local archeological sites.
<u>Gibson, Marvin</u> Address Unknown	Lives on Peter Hayes Hill Road, Pritchett 7.5' quadrangle. Reported an alleged Indian cemetery nearby but at an undisclosed location. Then became very hostile and threatening. Would not recommend this individual as an informant.
<u>Granberry, Doyle</u>	Reported McKenzie Mound (41WD55) and helped coordinate excavations by Dallas Archeological Society.
<u>Martin, F. C.</u> Address Unknown	Lives on Peter Hayes Hill Road, Pritchett 7.5' quadrangle. Knowledgeable about old homestead sites on Pritchett and Big Sandy quadrangles near Union Grove Baptist Church.

Poor, William Big Sandy, TX (214) 636-4637	Local amateur quite knowledgeable about local archeology. Has large collection from area. Good contact.
Skiles, Robert 420 W. Buchanan Mineola, TX 75773 (214) 569-2258	Local archeologist, most helpful to field crew. Had covered some of study area before and has collections of prehistoric and historic artifacts. Has run down names of landowners and mapped property lines--would be very valuable in further work in the area. Also knows local history and is well informed about Rhonesboro pottery. Indispensible contact.
Sparkman, James H., Jr. Texas Highway Dept. Mineola, TX 75773	Engineering technician for highway department. Aware of archeological activities in area. Small collection of prehistoric artifacts located at the Department.
Texas Archeological Research Laboratory Balcones Research Center 10100 Burnet Road Austin, TX 78758	Major source of reported information on Big Sandy area, as well as others in Texas. Available information--site forms, field notes, map locations, newspaper clippings, etc., may be secured for cost of xeroxing and small search fee. Contact: Ms. Carolyn Spock.
Turbeville, B. R. 1043 North Johnson Mineola, TX 75773	Well informed and skillful amateur archeologist. Not visited by survey crew. Reported site 41WD28 (TARL files).
U. S. Fish & Wildlife Service Ecological Services 819 Taylor Street Fort Worth, TX 76102	This agency has done detailed habitat mapping of the project area. Preliminary data was kindly furnished to principal investigator by Jerome L. Johnson.
U. S. Soil Conservation Service Highway 80 Mineola, TX 75773	Has older soil maps of area.

APPENDIX II

CORRELATION OF FIELD CATALOGUE NUMBERS AND TEXAS ARCHEOLOGICAL RESEARCH LABORATORY NUMBERS

APPENDIX II

CORRELATION OF FIELD CATALOG NUMBERS USED IN REPORT WITH TEXAS ARCHEOLOGICAL RESEARCH LABORATORY NUMBERS

Field Number	Site Name	TARL Number	Pages
BS-0	Oxbow Return	41WD63	130
BS-1	Borrow Pit	41WD64	128
BS-2	Old Well	41WD65	129
BS-3	Steinstoff I	41WD66	122
BS-4	Turkey Creek	41WD67	123
BS-5	Steinstoff II	41WD68	125
BS-6	Cow Bells	41WD69	125
BS-7	Brown Bottle	41WD70	131
BS-8	Fields	41WD71	132
BS-9	Old Mill	41UR6	132
11-J	Roadside	41WD72	136
41WD31	Claude Burkett Farm	41WD31	126
41WD55	McKenzie Mound	41WD55	127
41WD57	Holly Lake Ranch	41WD57	127
41WD58	Holly Springs Baptist Church of Crist Cemetery	41WD58	126
41WD107	Cranston-Byrd Kiln	41WD107	128
OH-1	Abandoned Farm House I	41WD79	136
OH-2	Abandoned Farm House II	41WD80	137

APPENDIX III

SCOPE OF WORK

APPENDIX A

Big Sandy Reconnaissance Survey

Scope of Work

1. General.

a. Scope. The contractor shall conduct a literature search and background study, define pertinent problems in the study area, establish predictive models of site location, then test and refine the models with a probabilistic sample survey.

b. Objectives. This study will identify districts, sites, buildings, structures, and objects of interest or importance in architecture, science, history, or prehistory which would be affected by water control projects in the Big Sandy area. The result of the study will be a report discussing in general terms the significance or values of the cultural resources found or expected to be in the area, and provide theoretically based predictive models for the numbers, types, qualities, and distribution of sites in the area.

The work is to be conducted in accordance with and in partial fulfillment to the Fort Worth District's obligation under the National Historic Preservation Act of 1966 (P.L. 89-665); the National Environmental Policy Act of 1969 (P.L. 91-190); Executive Order 11593, "Protection and Enhancement of the Cultural Environment," 13 May 1971 (36 F.R. 8921); the Advisory Council on Historic Preservation, "Procedures for the Protection of Historic and Cultural Properties" (36 CFR 800); TM 5-801-1, Historic Preservation: Administrative Procedures; and the proposed guidelines (Exhibit 1) on recovery of scientific, prehistoric, historic, and archeological data.

c. Study area. The region to be included within this study is bounded on the south by U.S. 80, on the west by F.M. 14, on the north by latitude 32° 52.5', and on the east by a line bearing southeast from the intersection of the north boundary with F.M. 582 through Ambassador Airfield, approximately 3 miles east of the town of Big Sandy. General background literature outside this area, however, is to be consulted as appropriate.

2. Work to be Performed.

a. Background and Study and Research Design. The contractor shall conduct a background study and literature search to examine extant source of information, including both published and unpublished reports, site files at local and state institutions, the National Register of Historic Places, the State Historic Preservation Officer, historical archives, and other such sources of information to locate pertinent data about the history and archeology of the project area. General prehistoric and historic outlines shall be drawn from a wider area as needed to understand the potential for the study area. The contractor shall also contact and interview local groups and individuals who might have specific knowledge about the project area. The purpose of this search is to identify known properties and to obtain information about their significance. An annotated list of non-bibliographic sources found will be produced as an appendix of the report. The literature search shall be further used to provide an initial estimate of the cultural resource density, variability, and pattern to be expected at different time periods in the project area. Problems of importance to

archeology that can be addressed by historic and prehistoric sites in this region shall be identified and discussed, including the types of data that would be needed to solve each. The problems should be derived from multiple sources and should be categorized by type of problem and period of applicability. Data from this study shall be applied toward the solution of a specified subset of these problems.

A draft of the background study and literature search, which is to include all known sites and a bibliography, is to be submitted to the Contracting Officer or his representative prior to initiation of the sample survey. The draft shall include in it a research design in which are stated the anthropological, archeological, and historical problems this work will attempt to resolve, the hypotheses derived from these problems, and the methods to be used to gather data suitable for addressing the problems and analyzing the data. A theoretically derived quantitative model for each cultural period will be developed, and details given on how the data are to be analyzed to validate and improve these predictive models. The contractor will provide explicit statistical evaluations of each model's reliability and validity. The design should specifically deal with multiple time periods of cultural significance. The design should detail the survey methods, stratification of the landscape, randomizing methods to ensure statistical validity, crew sizes, data to be recovered from each parcel surveyed and from each site, and proposed data recording formats. Site definitions for use in the field should be specified, including how small sites, closely adjacent sites, and isolated finds are to be treated. The Contracting Officer or his representative may require clarification or amplification within 14 days of the date of receipt of the draft background study and research plan.

b. Sample survey. Using information gathered from the first part of this scope of work, the contractor shall design and implement a sample survey of 1,280 acres of the project area. This survey should be statistically randomized so as to produce valid data concerning the probable distribution and density of archeological and historical sites. This sample also should be stratified to include representative portions of the different environmental zones identified in the literature search. Individual sample units should be large enough and sufficiently well defined to be easily relocated in future studies.

The survey will need to utilize frequent subsurface samples of the surveyed areas in order to maximize site location. Where necessary, the survey should utilize efficient methods of clearing the ground surface at appropriate intervals so as to better locate artifacts or other cultural features. Subsurface sampling shall be conducted as necessary, but shall primarily be confined to areas where geological examination reveals recent deposition has obscured potential culture bearing deposits. For each surveyed parcel of land, notes should be made of the crew members, transect intervals, time and date of start and finish, the surface conditions, any clearing or subsurface tests made, the area of the parcel, the man-hours spent surveying it, and any other conditions that could affect the discovery of sites.

Upon encountering artifactural remains, more intensive examination will be conducted in the nearby area to determine if the area is a site and, if

it is, its extent. Any collected artifacts will be recorded within 2 meters of their provenience. Boundaries of all sites should be precisely defined and plotted on the appropriate maps or aerial photographs. Testing for depth, cultural period, affiliation, and function of sites located under this contract will not be required, although these factors should be determined if possible. Data to be collected under this contract are to include the boundary, area, evidence of any disturbance, variables of the local environment (e.g., slope, soils, distance to nearest water, geological situation, vegetation, elevation, topographic situation, and drainage type and name), as well as any local landmarks that could be used to relocate the site. Pollen samples and soil samples shall also be recovered. Other data pertinent to the problems, hypotheses, and test implications stated in the research design are to be gathered, if possible, during the recording of the site. Sites should be marked with a non-perishable marker, numbered but not otherwise identified, the location of which is identified on the boundary maps. All test pits are to be backfilled. All sites located shall be recorded on Texas Archeological Research Laboratory forms and submitted for TARL assigned site numbers. No collections shall be made except as deemed necessary by other scope of work requirements.

The survey should also routinely collect information about the environment to supplement and refine the stratification parameters of the area. The contractor will use the data gathered at this stage of the survey to test the models developed in the literature search and to refine or change the models as necessary to incorporate the expanded information base.

Consideration should be given to innovative methods and techniques to locate sites. Remote sensing techniques should be used whenever their use would improve efficiency and accuracy.

3. <u>Reports</u>. The contractor shall provide a draft background study and research plan, monthly progress reports, survey forms and site boundary maps, and a final report as detailed below.

a. Draft background study and research plan. Two copies of the draft study specifying the theory and method to be used in accomplishing the sample survey specified by this scope shall be submitted by the contractor before proceeding with the field work. The research design will be used to guide the field and laboratory work unless revisions or clarifications are required by the Corps within 14 calendar days of its receipt. Contents will include the theoretical approach to the investigation, details of how the theory will be implemented in the data gathering process, problems identified in the literature search, plans to use any special analyses, the statistical procedures to be used in connection with the survey, and initial formulation of the predictive site location models, and a list of hypotheses for both the historic and prehistoric data. Sufficient test implications will be given for each hypothesis to be tested to allow its testing with data reasonably expected to be recovered in the project area. Examples of the types of problems to be considered include, but are not limited to, the following: Chronological refinement of the archeological data, including

the development of chronologically significant variations in non-projectile or non-ceramic implements, seasonal patterns of resource exploitation at various periods, including definition of the various forms of energy available from the environment, paleoclimatic and paleoenvironmental reconstructions as they affect man's use of the environment, the systemic structure of past cultural systems and their changes over time, activity patterning and site utilization, trade and contact with other systems, and the geomorphological and pedological history of the area and its implications for the paleoenvironment.

A statement indicating how quality control is to be maintained is also required.

b. Monthly progress reports. Progress reports will include a statement reviewing the work accomplished since the last report. This report also will detail the percentage completion of each phase of the work, including the progress of each chapter.

c. Boundary maps and survey forms. The boundary of each site and survey area shall be placed on topographic maps and/or aerial photographs. The location of test holes shall also be mapped. The maps should include information to help in the relocation of the site, the location of any subsurface tests, soil and pollen samples, and the identification marker. One copy of each survey form (which shall also be submitted to the Texas Archeological Research Laboratory) shall be supplied the Corps. When the site number has been assigned, a list of these numbers indexed to the temporary field numbers shall also be furnished the Corps.

d. Final report. The contractor shall prepare a final report describing the work done, the methods and results, and recommendations for additional work. The report shall include, but is not limited to, the following sections: An abstract and introduction, the archeological and historical background, an environmental description, a section on the theoretical approach and the methods used to implement it, a description of the sites and artifacts found, an analysis of site location parameters as used to predict site locations, a conclusion section, references cited (in the format of either the American Anthropological Association or the Society for American Archeology), and the annotated list of source material for the archeology and history of the area. The above items may not necessarily be discrete units but shall be readily discernible to the reader. Some of this report will be composed of the background and proposal already submitted.

The title page of each report shall include the names of its principal author(s) (not the corporate name), identify the U.S. Army Corps of Engineers, Fort Worth District as sponsor, the number of the contract under which the work was executed, and the date of the report. The principal investigator, if not the principal author, should be identified with "Report prepared under the supervision of ________________________, Principal Investigator."

Specific locational data that would allow sites to be easily found by readers may be placed on special tear-out sheets or on separates in a map

pocket. These specific locational data will not be publically distributed except on a "need to know" basis for agencies and archeological and historical professionals.

Maps shall be developed out of the predictive models that detail the probable density of sites at different time periods in the study area, as well as a map summarizing the above information in an estimate of the probable relative cost of archeological mitigation of adverse effects. Zones of differing costs shall be developed using criteria of site size, ground disturbance, complexity, and uniqueness. Each of these maps shall be clearly marked in large letters "PRELIMINARY DATA - DO NOT USE FOR DETAILED PLANNING" and a clear explanation of the limitations of the map and its interpretation shall be placed on the sheet.

Five copies of the draft final report will be furnished the Contracting Officer for review and comment. The report may also be submitted to other interested, qualified persons at this time for their comments. The draft report shall be substantially complete at the time it is submitted, containing all tables (not necessarily in final typed form) and at least sketches of the figures and photocopies of the photographs. The contractor is encouraged to submit sections of the report, as the first drafts are finished, to the Contracting Officer's representative for informal comments in advance of the final review. Changes suggested by the Government that are acceptable to the contractor shall be incorporated into the final report. Changes requested but unacceptable to the contractor shall be resolved in pre-publication conferences with the Government.

The contractor shall submit 100 copies of the final report together with a suggested list of state and local agencies, institutions, and concerned individuals who would be interested in or need to receive the report.

4. <u>Delivery Schedule</u>.

a. Draft background study and research design. Due 42 days from receipt of notice to proceed. Requests for clarification or revision to be returned by the Corps within 14 days of receipt of the research design. The contractor will then have 14 days to re-submit his research design, with all necessary changes & revisions.

b. Monthly progress reports. Due on 10th day of each month.

c. Draft of final report, survey forms, and site boundary maps. Survey forms and site boundary maps due nlt 80 calendar days after ntp. Draft of final report due nlt 122 calendar days after reciept of notice to proceed.

d. Final report. Due 45 calendar days from receipt of comments on draft report.

It is recognized that occasional mitigating circumstances may require a change in the due date of the report(s) submitted under the terms of this contract. The due date of the report(s) may be extended, upon application from the contractor, by a letter from the Contracting Officer. The contractor should clearly cite the reasons why an extension is required

and why it would be to the benefit of the Government to grant such a request. No change in the cost of the contract will result from a change in the due date of a report.

5. <u>Special Conditions</u>.

a. Performance of work. The contractor shall furnish sufficient technical supervisory and administrative personnel at all times to insure prosecution of the work in accordance with the delivery schedule. All work will be accomplished with adequate internal controls and review procedures which will eliminate conflicts, errors and omissions, and insure the technical accuracy.

b. Investigation of field conditions. The contractor acknowledges that he was urged to visit the areas where work is to be performed and by his own investigation, satisfy himself as to the existing conditions affecting the work to be done. The contractor agrees that if he chooses not to visit the area, he will nevertheless be charged with knowledge of conditions which a reasonable inspection would have disclosed. The contractor shall assume all responsibility for deductions and conclusions as to the difficulties in performing the work under this contract.

c. Inspection and coordination. The Contracting Officer or his representative may, at all reasonable times, inspect or otherwise evaluate the work being performed hereunder and the premises in which it is being performed. If any inspection or evaluation is made by the Government on the premises of the contractor, the contractor shall provide all reasonable facilities and assistance for the safety and convenience of the Government representatives in the performance of their duties. All inspections and evaluations will be performed in such a manner as will not unduly delay the work. Close coordination will be maintained between the principal investigator and the Contracting Officer or his representative to insure that the Government's best interest is served.

d. Data and materials furnished by the Government. Existing reports, maps, drawings, and aerial mosaics and photographs will be made available to the extent required to support study requirements.

e. Disposition of relics. The contractor shall consult with the Contracting Officer or his representative to determine the most appropriate depository for relics, specimens, and tapes and transcripts of interviews recovered as a result of the work performed pursuant to this agreement and furnish to the Government, if requested, the artifacts and notes from this research.

f. Meetings and conferences. Periodic meetings and conferences, not to exceed an average of one a week, shall be held whenever requested by the Contracting Officer or the contractor for discussion of questions and problems relating to the work required under the contract.

g. Site visits, work, and investigations. The contractor and/or his representative(s) shall visit, work, and investigate the specified sites as necessary and required to accomplish the work as specified herein. All travel, costs, and expenses incurred by the contractor and/or his representatives(s) including consultants for site visits, work, and investigations are included in the lump sum price of the contract.

h. Travel. If the contractor and/or his representative shall be required to travel to locations not specifically covered in the lump sum price of the contract, the Government will reimburse the contractor for the transportation, including pullman where necessary, and allow for such travel not to exceed the then current daily rates for Government employees, including per diem, mileage, etc., in lieu of all other expenses. Transportation by automobile on such required travel shall be likewise reimbursed. Travel time and mileage will be determined in accordance with Joint Travel Regulations. All travel shall be either authorized or approved in writing by the Contracting Officer. Should the contractor, or any representative thereof, remain in travel status in excess of 6 days at any one time, not including the time consumed in travel, the cost for such excess travel status shall be at the expense of the contractor, unless otherwise ordered in writing by the Contracting Officer.

i. Access. The contractor shall obtain necessary permits, licenses, and approvals from all local, State, and Federal authorities as are necessary for the performance of the contractor's services. Should it become necessary in the performance of the work and services for the contractor to secure the right of ingress and egress to perform any of the work on properties not owned or controlled by the Government, the contractor shall secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event the owner requires the payment of any fee for a license to enter upon and/or use such property, the contractor, when so directed by the Contracting Officer, shall pay such fee and obtain a receipt therefor. The expenditures covering such constitute a reimbursable item under this contract, and the contractor, upon presentation of a voucher therefor, duly supported by proper receipts attached thereto, shall be reimbursed for the full amount thereof.

Written agreements regarding the disposal of any artifacts recovered from private property should be obtained before collecting cultural resources. Every effort should be made to provide for the retention of these objects in the public domain.

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